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The Task III objective was to evaluate the relationship between stationary source performance over time and the regulatory process. Emphasis is on the effectiveness of the state/city regulatory activities without regard to which agency is implementing them. The report includes suggestions for the incremental modification of the regulatory system and for further analysis involving major modifications of the regulatory process.

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EFFECTIVENESS OF THE REGULATORY PROCESS AND SOURCE PERFORMANCE: CHICAGO, ILLINOIS, CASE STUDY

September 1979

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EXECUTIVE SUMMARY

The present study encompasses a description of the regulatory process for the Chicago Illinois case study. The report represents the culmination of an eleven month effort that focused first upon a detailed review of the regulatory structure as it exists (and has existed since 1970) within the City of Chicago. This analysis which was summarized in the Task I report (final report dated October 1978) included a detailed review of the Illinois Environmental Protection Agency (IEPA) Headquarters and Maywood District Office; the Chicago Department of Environmental Control (CDEC); and the Illinois Pollution Control Board (IPCB). The focus of the Task I report was the identification and assessment of key regulatory programs and policies, as they have been developed and applied to stationary sources in Chicago during the time period between 1970-78.

At the conclusion of the Task I effort, PES staff embarked upon a detailed review of 23 facilities in the City of Chicago. The purpose of this effort was to gain an insight and technical perspective of the response (and the reasons for the response) by the stationary sources to the various regulatory initiatives in the city since 1970. The facilities ultimately visited were selected from a carefully constructed list of 30 - 60 facilities which were initially identified on the basis of size, age, pollution problems, compliance history, and status of compliance. The results of the industry survey were compiled and included in the Task II report (draft report dated January 1979). Through this effort, PES was able to reconstruct the compliance histories and assoicated interactions between the sample facilities and the respective regulatory agencies. Facility specific emission profiles and financially related compliance data were presented in the Task II report, as well as tentative conclusions regarding the general effectiveness of the existing and past regulatory programs in terms of bringing about and maintaining stationary source compliance in the City of Chicago.

The Task III report presented herein provides the results of the PES efforts to relate the Task I study to the Task II analysis, in order to produce as clear a picture as possible regarding the relative effectiveness of the state/local control strategies in bringing about stationary source emission reductions. This report first provides as assessment of the overall agency effectiveness in promoting stationary source compliance by summarizing the results of the data developed in the first two task studies. The report then reveiws and summarizes the identifiable source response factors, and compares these factors (where possible) both within and across various source categories. Next, the report summarizes the specific casual relationships that appeared to exist between the regulatory agencies and the affected sources. Following this discussion, the report addresses various incremental modifications that are being recommended by PES as a means of improving the effectiveness of the existing state/local regulatory system. Finally the report explores potential major modifications that could be considered in further detail, which - if adopted and implemented would represent a significant departure from the existing regulatory system, thereby, necessitating new enabling legislation at the federal/state local levels.

Annual emission inventory summaries indicate that between 1972 and 1978, total hydrocarbon emisssions have been reduced by 59 percent, total suspended particulates (TSP) by 50 percent, and sulfur dioxide emissions (SO_2) by 57 percent within the City of Chicgo. At the same time, control agency data indicates that of the over 17,000 sources in the State of Illinois approximately 1500-1800 are "major" sources of which 500 - 600 are located within the City of Chicago. Thus approximately 30-40 percent of the major sources in Illinois are found in Chicago. During this time period, IEPA resources devoted to "compliance" activities have risen from 30 percent to 70 percent of the total agency resources. At the same time, between 1974 and 1978, the IEPA air programs budget has expanded 70 percent from $2.5 million to $4.3 million. From 1972 to 1978, the CDEC air program budget grew from $2.5 million to $4.0 million, for an average increase of 10 percent per year.

Both the IEPA and CDEC compliance strategies have varied in past years as a function of changing environmental programs and priorities. The "backbone" of the IEPA strategies aimed at assuring initial compliance by stationary sources is the agency's extensive permit system, coupled with an agency policy of basing enforcement functions upon litigation. A strength of this program lies in the fact that the permit system provides a comprehensive pre-construction review of potential new sources. A wekness inherent in this approach is that the potentially extensive case backlog may actually delay actions against recalcitrant sources.

The framework of the CDEC program aimed at assuring initial compliance by sources is its construction permit system, coupled with an informal policy of striving for out-of-court negotiations to achieve compliance. A strength associated with this system is that it is interfaced with the city building permit procedure, thereby assuring comprehensive coverage of all new construction. A weakness associated with this procedure is that the CDEC permit system does not include an established set of technical review guidelines. Consistency and quality of review is dependent on "quasi-formal" interaction amongst CDEC staff.

The IEPA strategies aimed at assuring continued compliance by sources are centered around the agency's five year renewable operating permit system, coupled with its surveillance system which is operated out of the IEPA regional offices. A strength associated with this approach is that the renewable permit procedure assures at least a partial reinvestigation of all facilities. At the same time, a weakness in the program is that the initial permit renewals were not properly scheduled, which resulted in a "glut" of applications on the agency.

The CDEC programs aimed at assuring continued stationary source compliance are centered around the agency's annual certificate of operation coupled with an extensive network of mobile inspectors. A strength associated with this approach is that the roving inspectors provide an effective, quick-response mechanisms for surfacing and addressing visible emissions violations. At the same time, a weakness inherent in ths concept is that the mobile inspector system may not be very effective in addressing pollution violations associated with SO_2 or hydrocarbons.

The total IEPA program category costs associated with compliance and prevention in the City of Chicago have risen from approximately $852,000 in Fiscal Year 1974, to $1,228,000 in Fiscal Year 1979 (all costs calculated in 1978 dollars). These costs have been estimated from the total statewdie IEPA expenditures based upon the geographic distribution of major stationary sources. The CDEC program expenditures for enforcement, engineering and inspectional services have varied from $966,000 in Fiscal Year 1974 to a peak of $1,094,000 in Fiscal Year 1976 to a total of $976,000 in Fiscal Year 1978 (all figures expressed in 1978 dollars). During this same time period, the estimated IPCB program expenditures based upon case loads for sources within the City of Chicago have varied from $128,000 in Fiscal Year 1973 to a peak of $141,000 in Fiscal Year 1974 to a recent total of approximately $42,000 in Fiscal Year 1978.

In terms of control agency program costs per average ton of pollutant reduction within Chicago (based upon a composite of all pollutants), the IEPA costs have risen from over $6.50/ton in Fiscal Year 1974 to over $280/ton in Fiscal Year 1978. The estimated IPCB costs during this time period rose from over $1.00/ton to nearly $10.00/ton, while the CDEC costs rose from over $7.00/ton to over $220.00/ton. On the basis of average control agency costs per major stationary source, IEPA costs have varied from over $1,500/source in Fiscal Year 1974 to over $2,200/source in Fiscal Year 1978; while CDEC costs have varied from over $1,700/source in Fiscal Year 1974 to a peak of nearly $2,000/source in Fiscal Year 1976 to a current estimate of approximtely $1,700/source in Fiscal Year 1978. During the same period, IPCB costs varied from approximately $250/source to nearly $80/source. The composite average for all three regulatory entities for the five year period is approximately $1,260/source.

With respect to stationary source costs, the facility expenditures to comply have varied as a function of the particular facility involved, the process to be continued, and the potential control equipment to be utilized. The number of sources interviewed during Task II of the study, when coupled with the broad range of industry categories reviewed and the number of pollutants and processes involved, provides a relatively weak base with which to draw extensive conclusions regarding specific costs. Based upon the limited data received, an approximate average capital cost of $400,000 to $500,000 per facility was determined. However, this average figure can be misleading since the range of capital cost encountered varied from $2,000 to $5,000,000. Annual operating costs varied from $10,000 to $250,000 on a "per facility" basis, although in many instances, costs had to be estimated on a "per process" or "per unit" basis. Agency control efforts appear to have been somewhat successful (in the absence of any desired cost-effectiveness analyses or comparisons), since stationary sources have maintained an average continuous compliance rate of approximately 79 percent for the study period (based upon the sample group investigated by PES).

Specific source response factors are difficult to generalize based upon the limited sample group. Some source categories, such as steam generation and food products, have demonstrated more continuously favorable compliance records than others, such as chemical and printing/publishing. The less favorable compliance record across industry categories appears to relate back to the process/pollutant involved (notably HC emissions), while the more favorable compliance record tends to relate back to those sources of more "traditional" TSP emissions requiring proven control technology (e.g. baghouses, cyclones, etc.). Similarily within source categories, compliance histories tended to be more favorable in instances requiring less innovative or "technology-forcing" control devices.

Agency/source causal relationships are also difficult to generalize on the basis of the present study. Many isolated instances of favorable and unfavorable relationships were identified. The strength of the relationship in terms of bringing about and maintaining stationary source compliance appeared to be a function of the ability of a specific control agency program or action (such as a permit requirement or a notice of violation) to "mesh" with the decision making process ongoing at the facility (i.e. a corporate "frame of mind"). The specific corporate disposition to comply, in turn, appears to be the result of an extremely complex financial interaction that takes into account the physical parameters, profitability, and costs of compliance associated with any given process/facility.

Specific recommendations for incremental modifications to the existing regulatory structure are somewhat limited in scope due to the legislative framework suppporting the state/local control agencies. However, certain modifications are recommended from the view point of attempting to increase the relative effectiveness of the interrelated control programs with respect to the resources now being expended. In particular, there is a need for increased communication and source data sharing between the IEPA/CDEC in order to minimize program duplication. At a minimum, program liaison personnel should be established within each agency to assure a more continuous flow and/or exchange of compliance-related information. Further, a single, mutually compatible permit form should be established in order to provide "one stop" existing regulatory requirements. The permit form should be structured to provide the reasonable amount of data required by both agencies for both pre-construction and operating permit reviews.

Other incremental modifications with respect to the CDEC relate to the need to develop and implement a greater amount of in-house engineering capability relative to the permit application review process. Without more specific technical guidelines and written procedures, the lack of depth or inconsistent application reviews (although not apparent in the majority of instances) could serve to reduce the overall effectiveness of the city permit program in light of the resources being expended to carry out the program. With regard to the IEPA, the agency appears to need to develop a greater capability for on-site interaction with industry through its regional office structure, the agency should explore mechanisms for providing either more staff field time, or a greater reliance on the CDEC staff to handle field investigation within the City of Chicago.

From the context of major program modifications, PES is recommending the further exploration of several strategies based upon economic incentives, each of which would require additional legislation in order to be implemented in Chicago. Specifically, we are recommending a feasibility analysis toward implementation of emission tax or surcharge systems, the latter of which could be coupled with the existing emission limitation structure. Both systems (or variations thereof) would provide economic incentives to industry to reduce pollutant emissions when the marginal costs of compliance are equivalent to the marginal benefits derived from the control action.

Other major program modifications are based upon recommendations to improve the program interactions - both between the state/local regulatory agencies, and across various single purpose environmental initiatives. The intention here is to maximize the potential benefits associated with the various environmental objectives, while minimizing (or eliminating) program inconsistencies that tend to counteract or offset each other.

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Chicago Case Study

1.0 INTRODUCTION

1.1 PROJECT OBJECTIVES

In July 1978, the Council on Environmental Quality (CEQ) in association with the U.S. Environmental Protection Agency (EPA), contracted with Pacific Environmental Services (PES), Inc., to perform a study entitled, "The Effectiveness and Costs of Selected State and Local Regulations for the Reduction of Emissions to the Atmosphere from Stationary Sources: (Contract No. EQ8AC106). Under this contract, PES is to perform two case studies involving San Diego, California, and Chicago, Illinois. This report addresses the Chicago Case Study.

The overall study represents an initial effort to systematically collect and analyze data associated with State/local pollution control agency actions and industrial facility responses for the control of stationary source air pollutants, viz., total suspended particulates, sulfur dioxide, and hydrocarbons. These studies, plus others that are currently being performed, should continue the basis for development of subsequent strategy implementation guidance documents directed toward both the initial and continued control of stationary source air pollutants, with an emphasis on the proper operation and maintenance of installed control equipment.

The essential purpose of this study is to accomplish the following objectives:

- An analysis of the regulatory program employed in the two case study areas during the past eight years;
- An empirical determination of the nature and extent of stationary source responses to existing State and local air pollution control agency regulations in the two case study areas;

- An explanation of the reasons (technical, economic, administrative, etc.) associated with actual source responses; and
- A determination of the relationship of various regulatory actions to pollutant emissions reductions over time.

During the course of this study, particular emphasis was placed on the degree to which pollutant emission reductions were achieved and maintained over time. The desired result of this study was to examine (as systematically as practicable) and determine actual achievements, in terms of overall program effectiveness and associated costs of the State and local government, in bringing about the attainment and maintenance of the required pollutant emission reductions by stationary sources through direct regulations. The time of coverage associated with this study is from 1970 to 1978.

The entire study comprised slightly more than a two-person year level of effort over a nine month period of time. Of the three main phases, Task I for both case studies entailed a description and analysis of the agency regulatory process (approximately a two-thirds person year level effort); Task II addressed the response of selected stationary sources to direct agency regulation (slightly more than a one pearson-year level of effort); and Task III, the subject of this report involves a summarization and interpretation of the Task I and II reports (approximately a one-third person year level of effort).

1.2 PREVIOUS REPORTS

Task I and II reports have already been developed for the Chicago Case Study, and have been submitted to CEQ and EPA. These reports are briefly described below.

The Task I report addressed the regulatory process by focusing on the Illinois Environmental Protection Agency (IEPA) and the City of Chicago Department of Environmental Control (CDEC) rules, regulations, procedures, practices, and costs associated with the various stationary source control strategies applied by these agencies within the City of Chicago. Following an overview of IEPA and CDEC agency histories and organizational developments, detailed descriptions of various agency programs and strategies were provided. This overview addressed the emission inventories and the agency practices for gathering such data; construction and operation permits, systems and resources (where applicable); enforcement plus various agency activities, compliance efforts, and sanctions. In the course of these descriptions, indications were frequently provided of program costs, funding sources, personnel requirements, and activity levels. Sources of information for this report were the CDEC administrative and/or enforcement files and records, the IEPA permit and enforcement files and records, and personal interviews with key staff members of both agencies, as well as members of the Illinois Pollution Control Board and the EPA Regional office.

The task II report for the Chicago Case Study measured source performance under IEPA/CDEC regulatory programs and identified emission problems based upon specific industry case histories. While this report dealt with agency actions and source responses during pre-compliance and compliance phases, emphasis was placed upon continued facility compliance through the identification of emission exceedances, their causes, and the resultant emission levels; these were depicted in the form of time line annual and typical day emission profiles. Initial criteria associated with source selection dealt with the availability of abundant emissions data (i.e. TSP, SO_2, and HC from 1970-78); additional criterion included a representative mixture of source types, sizes, ownership, pollutants, control equipment, and compliance histories. Within the study, a total of 23 separate source analyses covering eleven generic industry categories were presented. Of the total number of inital sources originally selected (30), only seven were not visited by PES; all of which either indicated an unwillingness to cooperate with our study or simply refused to respond to our inquiries.

The significance of the Task II Chicago report relates to the compilation and analysis of data from numerous stationary sources that had not generally been available to public regulatory agencies prior to this time. In order to facilitate the voluntary cooperation of stationary sources in this research study, we assured them that they would remain anonymous to both CEQ and EPA, and that their industrial process/compliance data and related histories would be treated confidentially.

1.3 TASK III OBJECTIVES

The ojective of the Task III Chicago report is to evaluate the relationship between stationary source performance over time and the regulatory process. The basis for this evaluation is through the analysis of the data and results reported in the Task I and II reports. Emphasis in this report is placed upon the effectiveness of various IEPA/CDEC regulatory activities in reducing pollutants, without substantial regard to the particular agency implementing the action, that is, emphasis in the Task III report is being placed upon a particular control action and its resultant emission reduction (if any), and not which particular agency is implementing the action. The principal elements of this report include the following:

- An evaluation of agency effectiveness in promoting stationary source compliance through various control actions;
- An analysis of source performance and response factors;
- Suggestions for the incremental modification of the existing IEPA/CDEC regulatory system; and
- Suggestions for further analysis involving major modifications of the stationary source regulatory process.

The following sections comprise the Task III report on Chicago Case Study on agency effectiveness and source performance. Chapter 2 presents the agency effectiveness in promoting stationary source compliance; it summarizes materials from Task I report incuding major control agency regulatory programs and strategies, the formal and informal definitions of compliance, agency funding and costs, and stationary source capital as well as identifiable O & M costs.

Chapter 3 addresses stationary source response factors and provides a comparison among and between sources and source categories. This summarizes our Task II report by considering such factors as source interaction with the control agencies; control equipment installed; emission profiles; source decision making parameters; comparison of sources within generic categories; and comparison of sources across generic categories.

Chapter 4 analyzes the casual relationship between the control agency actions and the stationary source responses by the facilities covered by this study. The cause and effect relationship focuses on such factors and the control agency permits process; applicable control equipment; facility compliance schedules; control agency inspections; complaints handling; and the application of sanctions. The aim of this chapter is to affix a measure of effectiveness to agency approaches directed toward the reduction of stationary source pollutants.

Chapter 5 suggests various incremental modifications that could be applied to the existing State/local regulatory system. Incremental modifications are considered to be those types of actions which can be implemented within the existing adminitrative, regulatory, and legal framework. Topics addressed include the restructuring of agency activities and related control efforts associated with emission inventories, permitting, inspections, compliance schedules, and sanctions.

Chapter 6 suggests areas where further analysis might be directed vis-a-vis major modifications to the existing State/local regulatory system. Such major modifications would likely require changes in existing legislation in order to implement. The emphasis of this chapter falls on the consideration of economic incentivies (as opposed to disincentives), and the problems and prospects associated with the application of such market related mechanisams in order to attain and maintain air quality.

Overall conclusions to the Chicago case study are presented in Chapter 7. These seek to draw together major factors and findings associated with the effectiveness of the State/local control agency and stationary source relationships for the georgraphic areas encompassed by this study.

1.4 ACKNOWLEDGEMENTS

PES is extremely grateful for the assistance provided by numerous individuals and agencies in the source of this study. While they would be too numerous to cite here, the following deserve special mention for their efforts.

Of foremost importance was the assistance and cooperation provided by the respective State/local control agencies: The Illinois Environmental Control Agency; and the City of Chicago Department Environmental Control - now referred to as The Chicago Department of Energy and Environmental Protection. They permitted PES to have access to their files and records, and provided opportunities for lengthy conversations with key members of the control agencies' staff. Assistance was also provided by the U.S. Environmental Protection Agency, Region V, as well as the Illinois Pollution Control Board.

Equally important was the cooperation offered by those industrial representatives associated with the stationary sources included in this study. Without their voluntary assistance it would have been more difficult to clearly and accurately determine the full cycle of control agency and source interaction.

Lastly, but by no means least, we are extremely grateful for the guidance and advice provided by the Co-Project Managers, Dr. Gordon L. Brady II of the Council on Environmental Quality, and Mr. James Vickery of the U.S. Environmental Protection Agency, Program Evaluation, throughout the course of this study.

2.0 AGENCY EFFECTIVENESS IN PROMOTING STATIONARY SOURCE COMPLIANCE

2.1 INTRODUCTION

This section of the report reviews the overall effectiveness of the control agencies in promoting the ultimate compliance by affected stationary sources with applicable control regulations. This discussion centers first upon a brief review of the background data regarding the establishment and structure of the state/local control agencies (i.e. IEPA and CDEC). The review also addresses the various control agency interrelationships which have had a bearing upon the overall agency effectiveness. Next, the discussion highlights the key pollutants of concern with respect to this study and the Chicago region, as well as the trends of overall pollutant concentrations in recent years. The discussion then turns to a review of the major control agency programs and/or control strategies aimed at stationary source compliance, as well as related overall program costs, in terms of equipment installation as well as operating and maintenance costs. The section closes with an an overview of our conclusions regarding the ultimate regulatory agency effectiveness to date in bringing about stationary source compliance.

2.1.1 ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

The Illinois Environmental Protection Agency (IEPA) was established in 1970 through the Illinois Environmental Protection Act which was enacted by the State General Assembly and signed by the Governor in June of that year. Since its establishment, the IEPA has operated under the State of Illinois Air Pollution Control Regulations, which were adopted and included within The State Implementation Plan (SIP) in 1971. In addition to the establishment of the IEPA, the Environmental Protection Act also provided for the creation of two other distinct governmental units, sharing the inter related responsibilities for protecting the environment. The Illinois Institute for Environmental Quality (IIEQ; although more recently the unit has been retitled as Chicago Department of Energy and Environmental Protection), which is charged with the responsibility of serving as a research and technological investigatory group. The other entity, the Illinois Pollution Control Board (IPCB) serves as the rulemaking and public hearing body within the state. Thus apart from the IIEQ and the IPCB, the IEPA serves as the planning, implementing and enforcement arm of the state. The overall governmental structure and interrelationship of these agencies or bodies is depicted in Figure 2-1.

The IEPA is organized around semi-functional lines, with environmental media program divisions involved in planning, administration, permitting, surveillance, and monitoring. Other distinct divisions cover agency enforcement and internal administration activities. Within the structure of the IEPA (depicted in Figure 2-2), four program divisions are devoted towards assuring the initial and continued compliance by stationary sources:

- The Air Quality Branch is responsible for developing and testing the various control strategies that are ultimately adopted in the form of rules and regulations by the PCB.
- The Compliance Branch focuses its activities on field operations through regional offices (initially four, now three offices), which are responsible for stationary source surveillance (including regular and periodic inspection), monitoring and assistance in permit reviews.
- The Permits Branch administers the State permit system which include both construction and operating permits.
- The separate Enforcement Division maintains the necessary legal staff for case preparation and proceedings before the PCB.

The IEPA also operates three regional offices (air, water, land pollution) throughout the state (Maywood, Peoria, and Collinsville), with the Maywood office being responsible for the 19 counties in Northeastern Illinois (including Cook County and the City of Chicago. The staffing and associated responsibilities of each regional office have varied since 1970 as a function of SIP program priorities and available federal/state funding. In general, the regional offices serve as the spokesman and implementing "arm" of IEPA in the field. Specifically, the regional offices focus primarily upon industrial contact and communications, and participate to varying degrees in the state permit process by performing engineering reviews, stack testing, and SIP control strategy development.

Since the creation of the agency in 1970, the IEPA budget for air programs and corresponding staffing levels have grown steadily. From 1974, the agency and programs budget have expanded from approximately $2.5 million to $4.3 million in 1978-79. Similarily, the agency staffing level during the same time period has grown from approximately 115 staff to a total of over 150 individuals in fiscal year 1978. The relative growth of the state air program is illustrated (Figure 2-5 Task 1) in Figure 2-3. While the overall agency resources have grown by over 70 percent (in funding) and over 30 percent (in staffing), those resources within the overall budget devoted to enforcement and/or compliance activities have varied as discussed below.

The IEPA operates a permit system that includes both construction permits, and a five year renewable operating permit. The agency also conducts a rather extensive New Source Review (NSR) program involving both engineering and dispersion modeling analyses. Enforcement activities of the IEPA include general area surveillance through the regional offices, complaint investigations, Pollution Control Board actions, and legal case preparation in conjunction with the State Attorney General's office. Although the enforcement-related resources have varied through the years as a function of yearly agency commitments and/or program priorities (such as SIP development), the IEPA

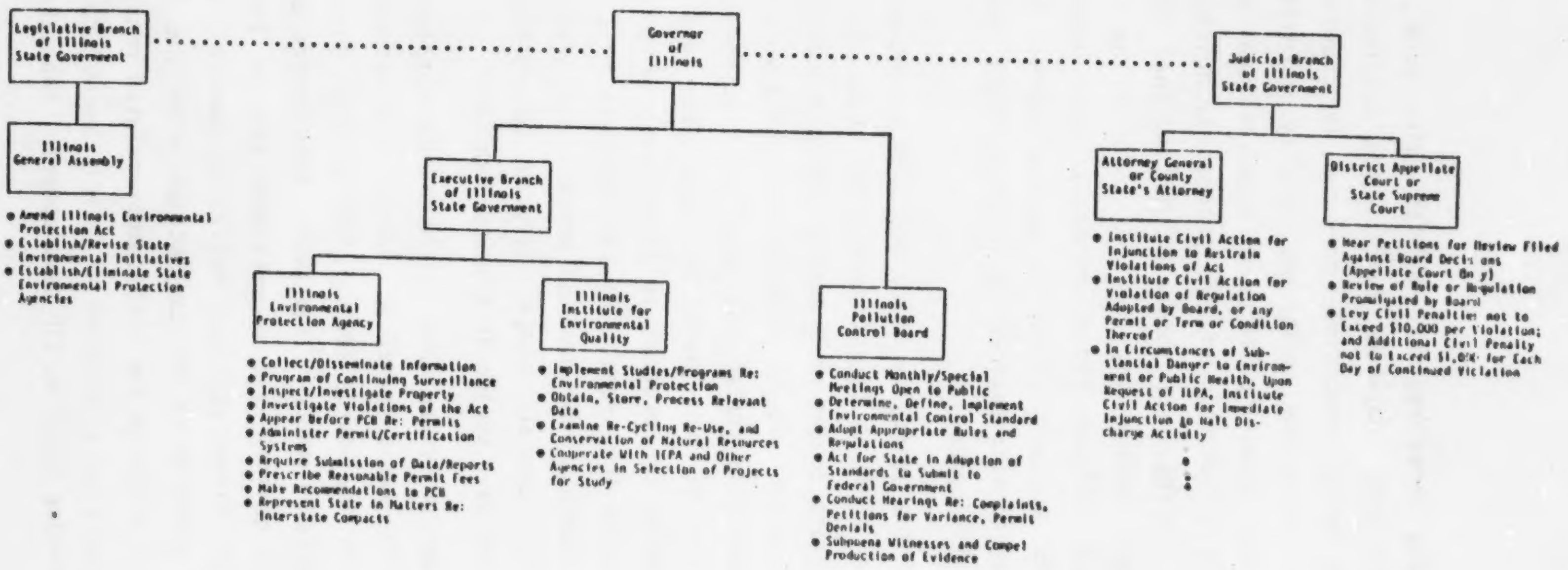

Legislative Branch of Illinois State Government
Illinois General Assembly
● Amend Illinois Environmental Protection Act
● Establish/Revise State Environmental Initiatives
● Establish/Eliminate State Environmental Protection Agencies
Governor of Illinois
Executive Branch of Illinois State Government
Illinois Environmental Protection Agency
● Collect/Disseminate Information
● Program of Continuing Surveillance
● Inspect/Investigate Property
● Investigate Violations of the Act
● Appear Before PCB Re: Permits
● Administer Permit/Certification Systems
● Require Submission of Data/Reports
● Prescribe Reasonable Permit Fees
● Make Recommendations to PCB
● Represent State in Matters Re: Interstate Compacts
Illinois Institute for Environmental Quality
● Implement Studies/Programs Re: Environmental Protection
● Obtain, Store, Process Relevant Data
● Examine Re-Cycling Re-Use, and Conservation of Natural Resources
● Cooperate With IEPA and Other Agencies in Selection of Projects for Study
Illinois Pollution Control Board
● Conduct Monthly/Special Meetings Open to Public
● Determine, Define, Implement Environmental Control Standard
● Adopt Appropriate Rules and Regulations
● Act for State in Adoption of Standards to Submit to Federal Government
● Conduct Hearings Re: Complaints, Petitions for Variance, Permit Denials
● Subpoena Witnesses and Compel Production of Evidence
Judicial Branch of Illinois State Government
Attorney General or County State's Attorney
● Institute Civil Action for Injunction to Restrain Violations of Act
● Institute Civil Action for Violation of Regulation Adopted by Board, or any Permit or Term or Condition Thereof
● In Circumstances of Substantial Danger to Environment or Public Health, Upon Request of IEPA, Institute Civil Action for Immediate Injunction to Halt Discharge Activity
District Appellate Court or State Supreme Court
● Hear Petitions for Review Filed Against Board Decisions (Appellate Court Only)
● Review of Rule or Regulation Promulgated by Board
● Levy Civil Penalties not to Exceed $10,000 per Violation; and Additional Civil Penalty not to Exceed $1,000 for Each Day of Continued Violation

Figure 2-1. Structure and Responsibilities of Illinois State Government With Regard to Environmental Protection

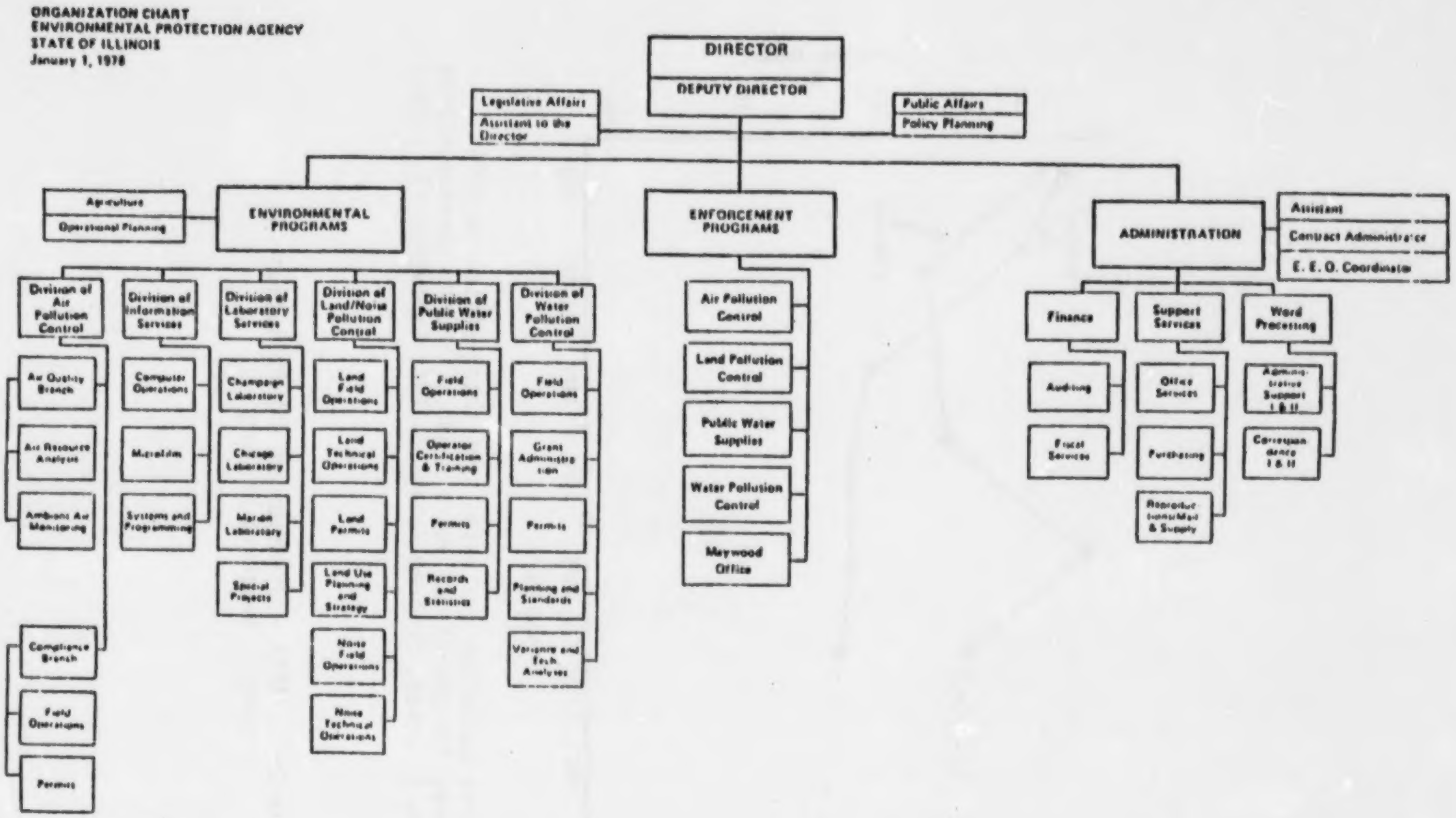
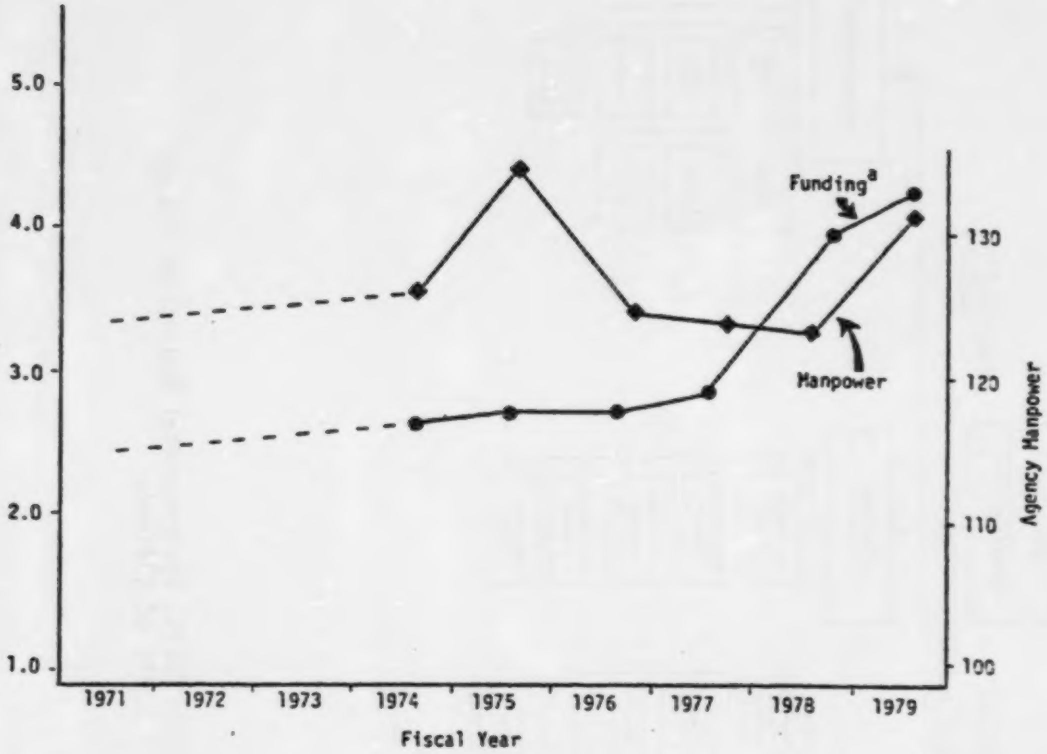


Figure 2-2. Organization Chart, Environmental Protection Agency
State of Illinois



[a]All resource estimates are based upon total statewide IEPA expenditures for the fiscal years shown. (Source correspondence from Wayne E. Jones, Program Manager; IEPA; September 13, 1978.)

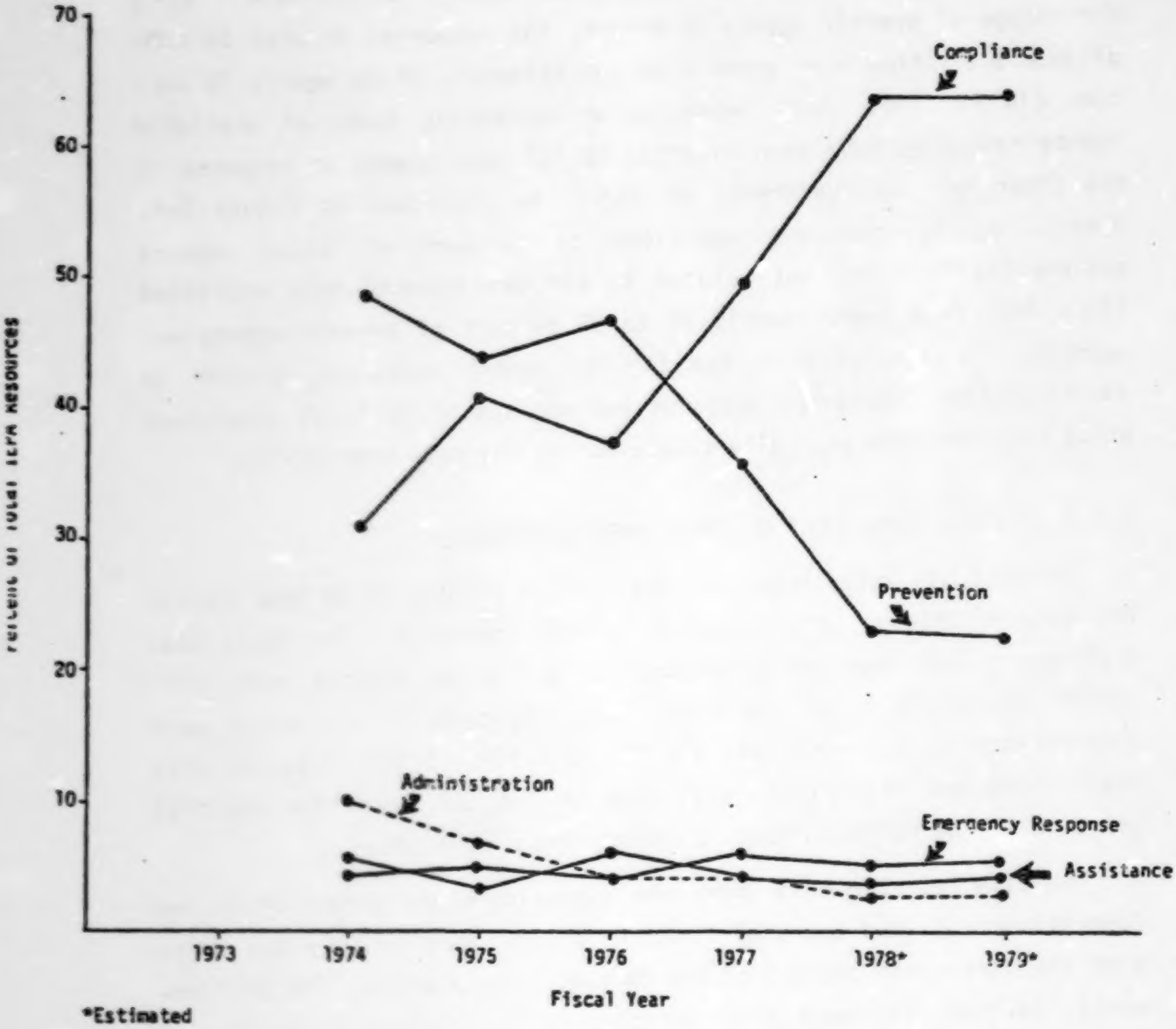
Figure 2-3. IEPA - Division of Air Pollution Control Resource History

has maintained a substantial commitment towards enforcement. As a percentage of overall agency resources, the resources devoted to compliance activities have grown from approximately 30 to nearly 70 percent (in FY' 79). More recently, an increasing level of available agency resources have been diverted to SIP development in response to the Clean Air Act Amendments of 1977. As indicated in Figure 2-4, overall agency resources dedicated to "prevention" (i.e. support engineering functions not related to SIP development) have decreased since 1972 from approximately 50 to 25 percent of overall agency resources. As indicated in the figure, agency resources devoted to administration, emergency response and assistance to local government units have remained generally stable during the same time period.

2.1.2 CHICAGO DEPARTMENT OF ENVIRONMENTAL CONTROL

The CDEC was established in 1969 through Chapter 17 of the Municipal Code of Chicago, Environmental Control Ordinance. The local control agency has operated under the air pollution control rules contained in Article II of the Code. The city control regulations were incorporated by reference into the Illinois SIP. Since 1972, the city regulations and associated local role in the SIP have been modified periodically to reflect changing environmental priorities.

The City Department is under the supervision and direction of the Commissioner of Environmental Control, who is appointed by the Mayor with the advice and consent of the Chicago City Council. The Environmental Control Ordinance also established in Advisory Environmental Contol Committee to the CDEC. The committee contains eight members including the CDEC Commissioner, as well as the Commissioners for the Departments of Streets and Sanitation; Water and Sewers; Health; and Buildings. All members of this committee including the three noncommissioners are appointed by the Mayor.



*Estimated

Figure 2-4. IEPA Air Program Elements as a Function of Total Statewide Resources

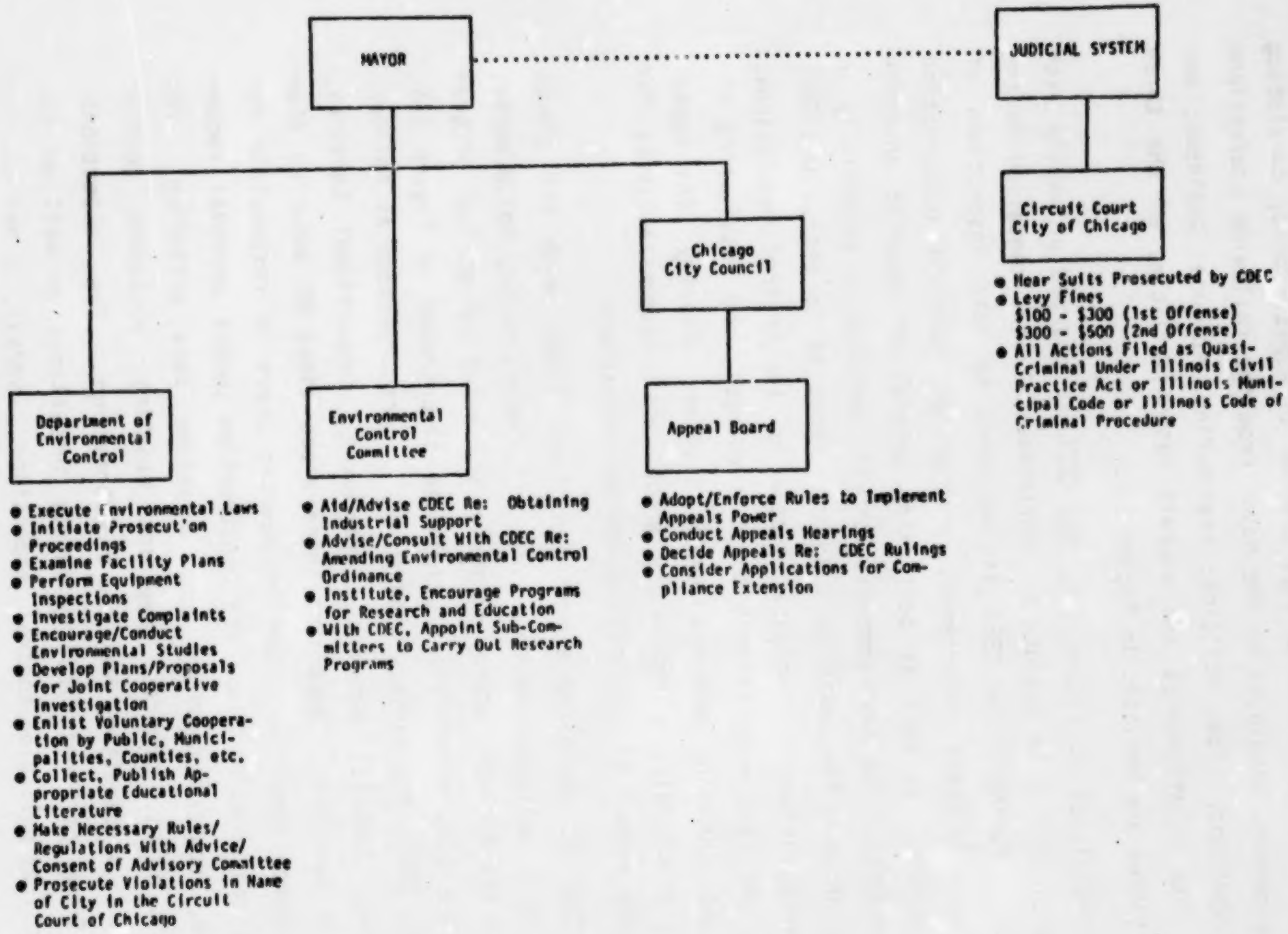

MAYOR
JUDICIAL SYSTEM
Circuit Court City of Chicago
Chicago City Council
Department of Environmental Control
Environmental Control Committee
Appeal Board
• Hear Suits Prosecuted by CDEC
• Levy Fines
$100 - $300 (1st Offense)
$300 - $500 (2nd Offense)
• All Actions Filed as Quasi-Criminal Under Illinois Civil Practice Act or Illinois Municipal Code or Illinois Code of Criminal Procedure
• Execute Environmental Laws
• Initiate Prosecution Proceedings
• Examine Facility Plans
• Perform Equipment Inspections
• Investigate Complaints
• Encourage/Conduct Environmental Studies
• Develop Plans/Proposals for Joint Cooperative Investigation
• Enlist Voluntary Cooperation by Public, Municipalities, Counties, etc.
• Collect, Publish Appropriate Educational Literature
• Make Necessary Rules/Regulations With Advice/Consent of Advisory Committee
• Prosecute Violations in Name of City in the Circuit Court of Chicago
• Aid/Advise CDEC Re: Obtaining Industrial Support
• Advise/Consult With CDEC Re: Amending Environmental Control Ordinance
• Institute, Encourage Programs for Research and Education
• With CDEC, Appoint Sub-Committees to Carry Out Research Programs
• Adopt/Enforce Rules to Implement Appeals Power
• Conduct Appeals Hearings
• Decide Appeals Re: CDEC Rulings
• Consider Applications for Compliance Extension

Figure 2-5. City of Chicago Environmental Control Structure
(Air Pollution Programs)

Finally, the city ordinance also created an Appeal Board, consisting of five members appointed by the Mayor from the following professions and occupations: law; medicine; engineering; science; business; and labor. The relationships and overall responsibilities of the three city entities are depicted in Figure 2-5.

As indiciated in Figure 2-5, the CDEC is charged primarily with the responsibility to execute the environmental laws contained in the ordinance. Further, the CDEC is empowered to make inspections of facilities, initiate enforcement proceedings, perform construction permit reviews, as well as performing general or specific environmental studies. The Environmental Control Committee is essentially an advisory group. The committee's central focus is to assist the CDEC in gathering industrial/municipal support of the control regulations, advising the CDEC with respect to rule changes, and instituting research and education programs and/or studies. Finally, the Appeal Board is essentially a regulatory group, with responsibilities for considering appeals to CDEC rulings and determinations.

The CDEC is organized around functional lines, with all groups spanning most pollutant medias, i.e., air, water, noise, solid waste, etc. (and now includes energy conservation) along categorical program areas. The CDEC organizaional chart is illustrated in Figure 2-6. Within the CDEC, the various program groups are organized as follows: Engineering, Technial Services, Enforcement, Inspectional Services, and Mobile Services. Concerning those areas aimed at assuring stationary source compliance, the Engineering Group is responsible for reviewing construction plans and construction permit approval recommendations, source sampling, and emissions data gathering. The Enforcement Group provides complaint handling, abatement control actions and preparation for court proceedings. The Inspectional Services Group performs facility safety inspections as well as the annual facility pollution control inspections. Overall, it has been

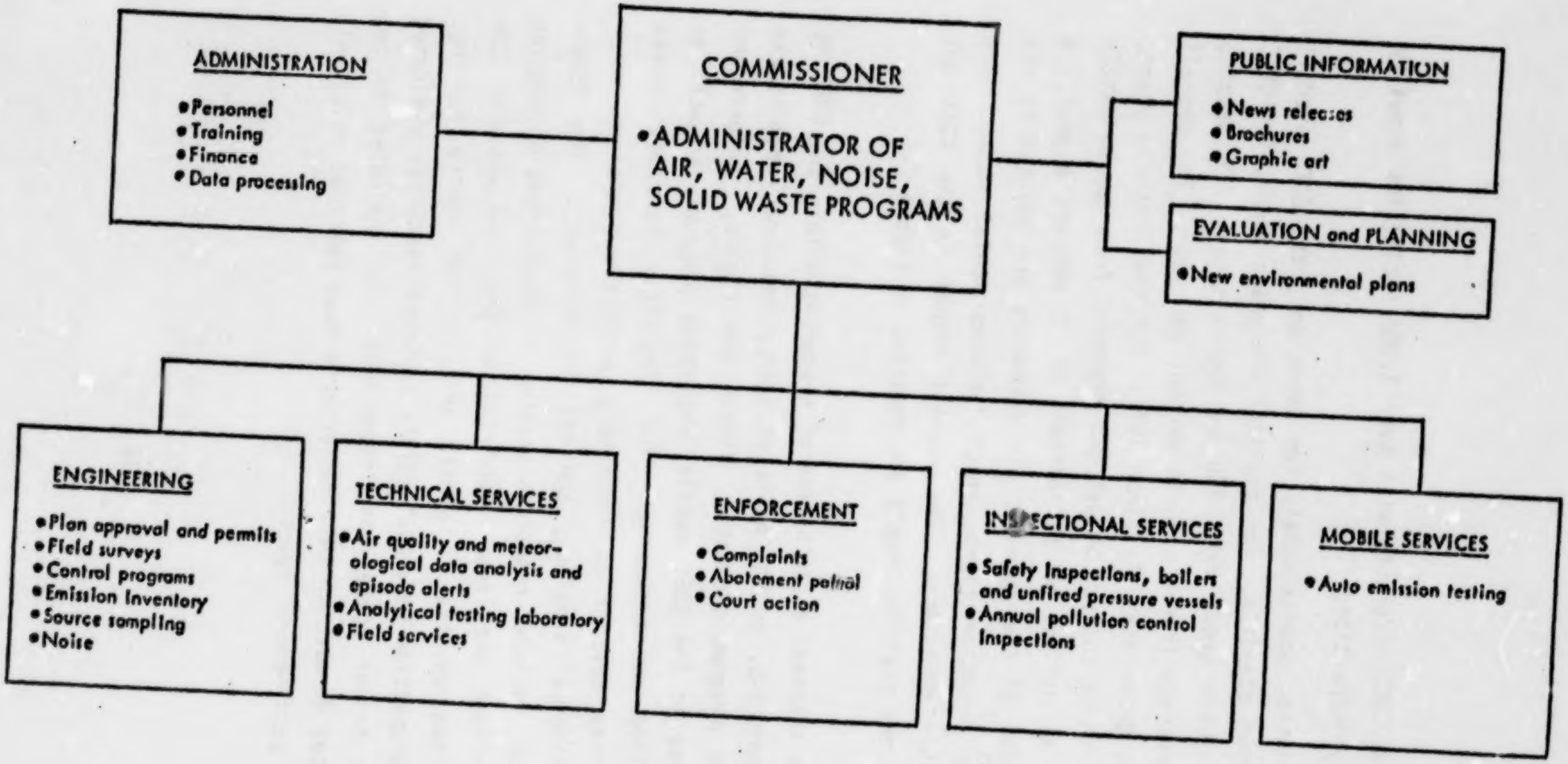


Figure 2-6. Functional Organization Chart, Chicago Department of Environmental Control, 1977
(Air Pollution Programs)

estimated that the CDEC interacts with over 3,000 facilities annually including facility inspections.

Since its creation approximately ten years ago, the CDEC overall staff size has grown steadily. For the last six years alone, the CDEC personnel levels have grown from 150 to approximately 275 people, representing an average increase of 14 percent per year. The overall agency budget has grown steadily since 1972. For the last six years, the CDEC air pollution control budget has expanded from approximately $2.5 million to $4 million or an increase of 10 percent a year. A significant portion of the agency's air resources are devoted to its extensive mobile inspector fleet, which includes aerial surveillance related to visible emissions. The overall trends in the CDEC air pollution budget and staffing levels are depicted in Figure 2-7

The relative internal distribution of resources within the CDEC is depcited in Figure 2-8, on the basis of agency resource expenditures with respect to program elements. Within the figure, "Enforcement Services" relates to the CDEC mobile inspection program, as well as complaint handling and ticketing. The "Technical Services" areas includes resources devoted to laboratory activities, ambient monitoring, meteorological sampling, and related personnel. The "Engineering Services" includes resources devoted to inspections of complex boiler installations and large industrial sources, and embodies the bulk of resources devoted to permit analyses and source testing. Finally, the "Inspection Services" relate to those resources dedicated to small-scale boiler operations inspections. As indicated in the Figure, resources devoted to this latter area have remained relatively stable for the past several years.

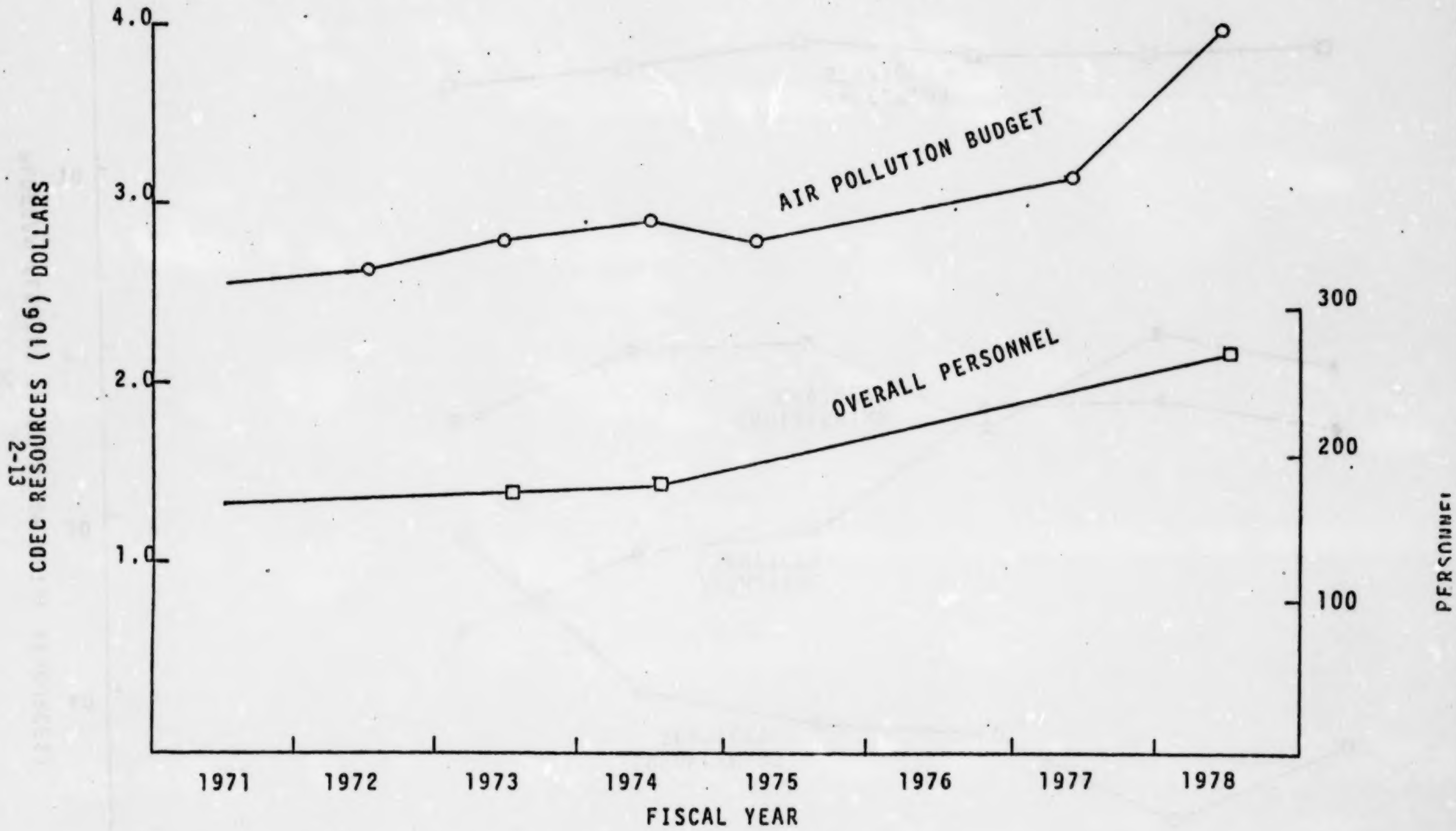


Figure 2-7. CDEC OVERALL RESOURCE HISTORY

(NOTE: ALL FIGURES ARE APPROXIMATIONS ONLY)

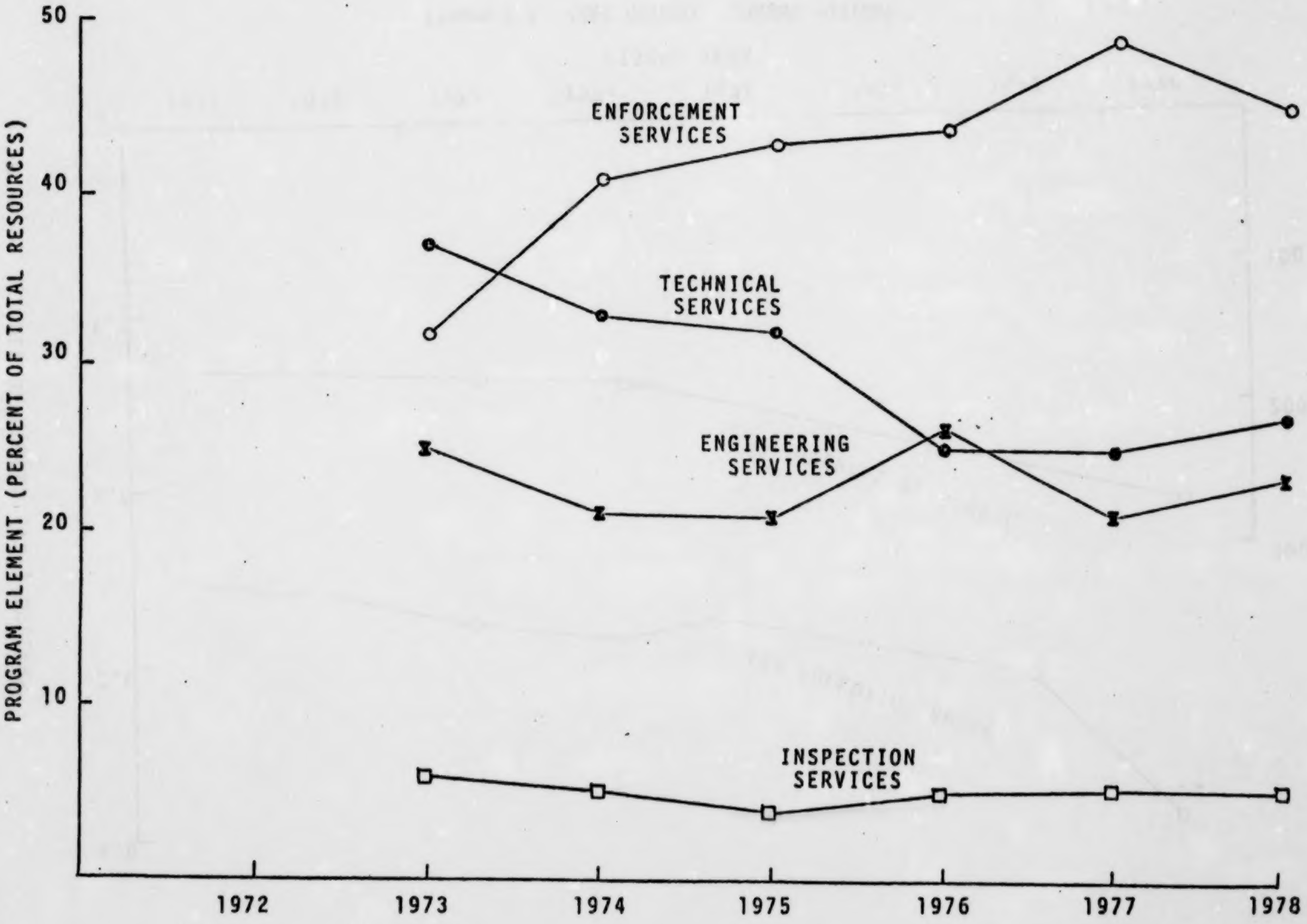


Figure 2-8. CDEC RESOURCE EXPENDITURES BY PROGRAM ELEMENT
(Air Pollution Programs)

2.1.3 INTERAGENCY RELATIONSHIPS

The IEPA relationship with the U.S. EPA is structured around the federally approved SIP. Within the context of the SIP control strategies, the IEPA receives a percentage of its overall funding from the Federal Government through Section 105 of the Clean Air Act. The funding mechanism is based around a fiscal year grant application process that recognizes overall resource constraints. Through a process analogous to the "zero-based budgeting" process, the IEPA must commit to a variety of control program priorities and resource elements. This annual program planning process, once negotiated between the IEPA and U.S. EPA, forms the basis of the state fiscal year grant application which, in turn, establishes the level of Federal/state/local funding for agreed upon programs in any given fiscal year. The overall IEPA funding levels from FY 74 through FY 79 are illustrated in Table 2-1.

The CDEC role in air pollution abatement and control is embodied in the Illinois SIP. Within the state plan, intergovernmental cooperation was highlighted initially in 1972, and is revised/updated annually in the form of an interagency agreement between the CDEC and the IEPA. The agreement reflects changing environmental program priorities and forms the basis for Federal funding of the CDEC for a given fiscal year. The written agreement covers such topics as: air quality monitoring; emergency episode and incident programs; asbestos demolition enforcement activities; and general facility information exchange between the CDEC and IEPA.

With respect to overall pollution control programs aimed at obtaining and maintaining stationary source compliance, the interagency agreement recognizes two separate and distinct permit programs operated within the Chicago city limits. The IEPA maintains its state construction and operating permit system, while the CDEFC maintains a city-wide construction permit program coupled with an annual facility

Table 2-1. ENVIRONMENTAL PROTECTION AGENCY
AIR POLLUTION CONTROL
PROGRAM ACTIVITY BY CATEGORY
PERCENT OF DIVISION EFFORT

	Fiscal Year 1974		Fiscal Year 1975		Fiscal Year 1976		Fiscal Year 1977		Fiscal Year 1978		Fiscal Year 1979	
	Actual		Actual		Actual		Actual		Estimated		Estimated	
Program Category	K Dollars	Percent	K Dollars	Percent	K Dollars	Percent	K Dollars	Percent	K Dollars	Percent	K Dollars	Percent
Compliance	753.5	31.1	1,151.4	41.2	1,022.7	37.6	1,433.4	49.5	2,563.1	64.0	2,746.7	64.2
Prevention	1,175.0	48.5	1,233.7	44.2	1,290.5	47.5	1,043.4	36.0	933.6	23.3	975.4	22.8
Assistance	138.1	5.7	88.1	3.2	163.9	6.0	124.4	4.3	155.1	3.9	185.4	4.3
Grants	0	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	111.4	4.6	135.4	4.8	118.0	4.4	162.7	5.6	206.0	5.2	214.3	5.0
Administration	244.7	10.1	184.7	6.6	122.6	4.5	134.5	4.6	145.9	3.6	155.5	3.7
Total Percent		100.0		100.0		100.0		100.0		100.0		100.0
Total K Dollars	2,422.7		2,793.3		2,717.7		2,898.4		4,003.7		4,277.3	

Source: Correspondence from Wayne E. Jones, Program Manager; IEPA; September 13, 1978.

compliance "certification" system. Moreover, both agencies maintain mutual enforcement programs, including systems for source surveillance. However, since the U.S. EPA must seek to avoid or minimize the Federal funding of duplicate environmental control programs, the IEPA focuses its state surveillance activities on stationary sources emitting greater than, or equal to 100 tons per year (potential) emissons of any criteria pollutant. At the same time, the CDEC maintains a city spot check program of such "major" sources, while focusing its actions upon the remaining facilities within the City. In addition, the CDEC maintains a stack sampling role, along with periodic, spot-check industrial inspection programs. The overall funding levels for the CDEC from FY 74 through FY 78 are illustrated in Table 2-2. As indicated in the Table, the percentage of Federal funding has reamined relatively constant during that time period, varying from 26.0 percent to 28.4 percent of the total program.

Any discussion of interagency relationships from the context of bringing about (and maintaining) stationary source compliance would not be complete without a brief discussion of the Illinois Pollution Control Broad (IPCB). Figure 2-1 depicted the structure and division of responsibilities within Illinois State Government with regard to environmental protection. As illustrated in the Figure, the IPCB maintains primary responsibilities for all rulemaking activities, including public hearings, adoption of rules and regulations, permit the levying of fines. The Annual Report of the IPCB dated August 1972 stated that

> "the Board itself resembles both a legislature and a court: In rule-making proceedings it adopts regulations of general applicability prescribing limits on pollution discharges of various kinds, and in individual complaints and variance cases it acts as a tribunal to determine whether violation is found."

Table 2-2

CHICAGO DEPARTMENT OF ENVIRONMENTAL CONTROL: AGGREGATE EXPENSES BY SERVICE GROUP

(Air Pollution Programs)

Element/ Year	City Funds	% Total	Federal Funds	% Total	Total Funds	% Total
1974						
Tech. Services	$256,821	31%	$132,903	41%	$1,145,549	33%
Enf. Services	343,106	41%	126,824	40%	469.930	41%
Eng. Services	179,184	21%	60,623	19%	239,807	21%
Insp. Services	55,088	7%	---		55,088	5%
TOTAL	$834,199	100%	$320,350	100%	$1,145,549	100%
1975						
Tech. Services	275,559	30%	131,411	38%	406,970	32%
Enf. Services	393,992	43%	149,387	44%	543,379	43%
Eng. Services	198,242	21%	61,400	18%	259,642	21%
Insp. Services	56,117	6%	---		56,117	4%
TOTAL	$923,910	100%	$342,198	100%	$1,266,108	100%
1976						
Tech. Services	237,200	25%	92,836	25%	330,036	25%
Enf. Services	425,017	46%	150,195	41%	575,212	44%
Eng. Services	210,514	23%	127,099	34%	337,613	26%
Insp. Services	60,784	6%	---		60,784	5%
TOTAL	$933,515	100%	$370,130	100%	$1,303,645	100%
1977						
Tech. Services	252,763	25%	83,576	23%	336,339	25%
Enf. Services	497,894	50%	166,597	46%	664,491	49%
Eng. Services	172,359	17%	114,704	31%	287,063	21%
Insp. Services	68,340	8%	---		68,340	5%
TOTAL	$991,356	100%	$364,877	100%	$1,356,233	100%
1978*						
Tech. Services	280,327	28%	82,664	23%	362,991	27%
Enf. Services	437,012	44%	160,801	45%	597,813	45%
Eng. Services	194,727	20%	110,257	32%	304,984	23%
Insp. services	73,173	8%	---		73,173	5%
TOTAL	$985,239	100%	$353,722	100%	$1,338,961	100%

* Projected

The IPCB has been extremely active in the area of case loads handled including variance requests/appeals, IPCB enforcement cases, and enforcement cases filed by citizens and/or the State Attorney General. Tables 2-3 and 2-4 provide a relative distribution of IPCB case load activities for FY '71 through FY '77. The table also provides an approximate percentage of those cases related to air pollution as opposed to cases involving the other environmental media. The percentages reflected in both tables again indicate the "real peak" of activity that was apparent with both the IEPA and the CDEC. That is, after an initial "flurry" of activity in FY '71-72, activities related to air abatement dropped and then gradually increased to a second peak around FY '74-75, which was the time period established as the initial attainment date for the amient air quality standards.

2.2 MAJOR POLLUTANTS, TRENDS, AND SOURCE CATEGORIES IN CHICAGO

The air pollutants of primary concern with respect to stationary sources within the City of Chicago are total suspended particulates (TSP), sulfur dioxide (SO_2), and photochemical oxidants (O_x). The latter pollutant is formed in a complex photochemical reaction involving hydrocarbons (HC) nitrogen oxides (NO_x), and oxygen in the presence of sunlight. Oxidants are usually measured as ozone. Hydrocarbons are a contaminant primarily associated with the production and use of petroleum products, with the pollutant emissions resulting from evaporation and/or incomplete combustion. The NO_x emissions are formed as a result of high temperature combustion processes due to the prevalence of nitorgen in the atmosphere. In the Chicago area, mobile sources account for at least one half of the HC/NO_x emissions.

Table 2-3

ILLINOIS POLLUTION CONTROL BOARD
FY CASE DISTRIBUTION

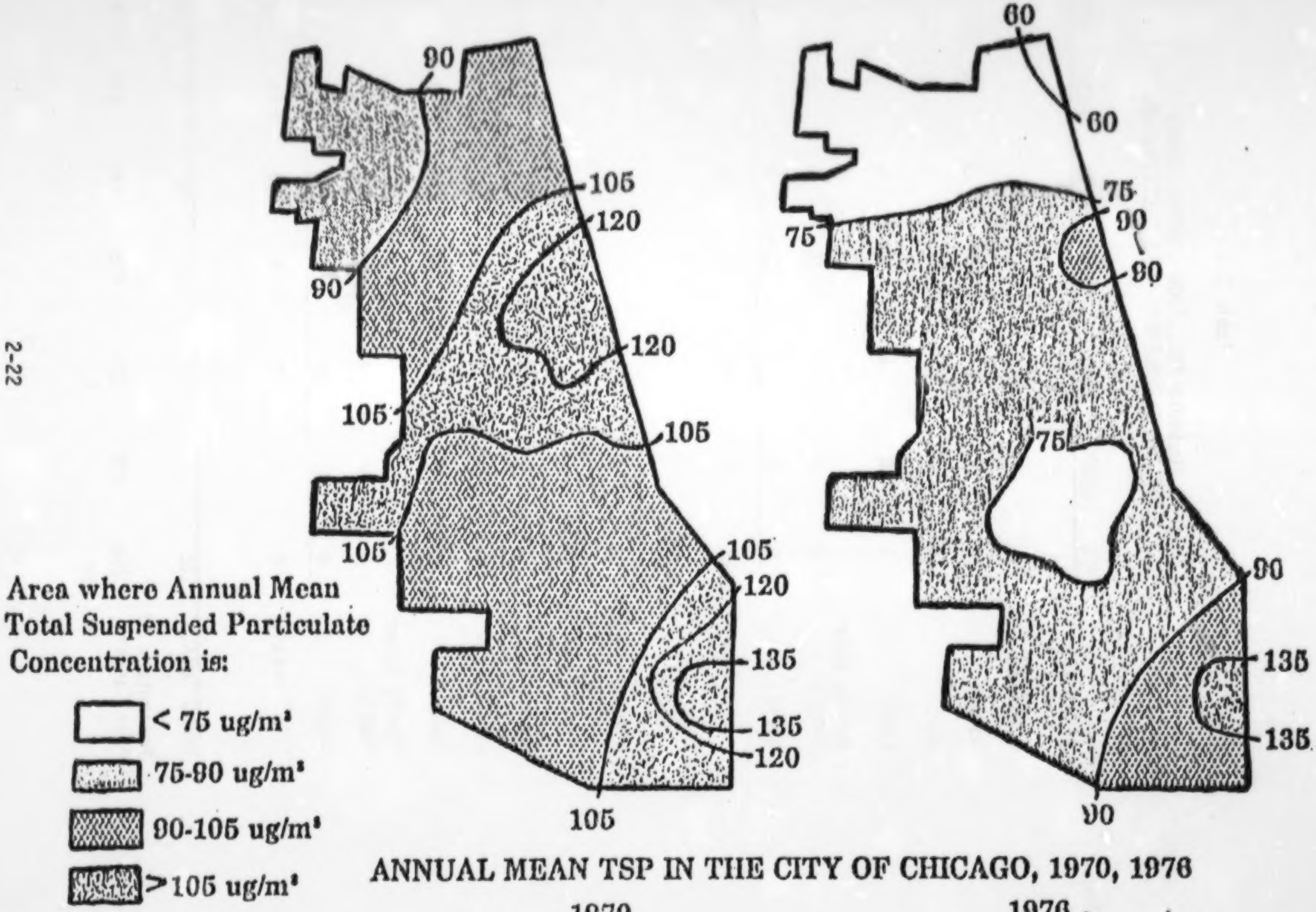
	FY71	FY72	FY73	FY74	FY75	FY76	FY77	TOTAL
VARIANCES:								
Water:	56	126	168	126	102	103	155	826
Air:	101	144	145	217	185	81	20	893
Land:	2	12	18	12	12	9	6	71
Public Water Supply:	2	5	30	22	17	5	3	84
Noise:	0	0	0	0	1	5	3	9
Total:	161	287	361	377	317	203	187	1893
ENFORCEMENT CASES								
Water:	25	52	36	35	42	43	29	262
Air:	26	100	68	79	49	52	21	395
Land:	12	53	35	13	57	63	22	255
Public Water Supply:	1	4	1	4	14	27	8	59
Noise:	0	0	0	1	11	10	9	31
Total:	64	209	140	132	173	195	89	1002
NUCLEAR PERMITS:								
	2	3	0	0	0	0	0	5
PERMIT APPEALS:								
	0	0	12	21	15	29	21	98
OTHER:						9	20	29
GRAND TOTAL	227	499	513	530	505	436	317	3027
Percentage of "Air Cases"	56%	49%	42%	56%	46%	31%	13%	

Table 2-4

ILLINOIS POLLUTION CONTROL BOARD
CITIZEN ENFORCEMENT - FY DISTRIBUTION

	FY71	FY72	FY73	FY74	FY75	FY76	FY77	TOTAL
FILED BY:								
CITIZENS								
Water:	0	6	17	15	5	4	3	57
Air:	4	6	7	9	4	5	3	38
Land:	1	0	4	4	1	3	6	19
Public Water Supply:	0	0	0	0	3	0	0	3
Noise:	0	0	1	1	3	3	2	10
Total:	12	12	29	29	16	15	14	127
FILED BY								
ATTORNEY GENERAL (PEOPLE OF THE STATE OF ILLINOIS)								
Water:	0	0	0	1	7	2	10	20
Air:	0	0	2	7	18	8	9	44
Land:	0	0	0	0	2	4	6	12
Public Water Supply:	0	0	0	0	3	0	0	3
Noise:	0	0	0	0	0	1	1	2
Total:	0	0	2	8	30	15	26	81
GRAND TOTAL	12	12	31	37	46	30	40	208
Percentage of "Air Cases"	25%	50%	29%	43%	48%	43%	23%	

Figure 2-9



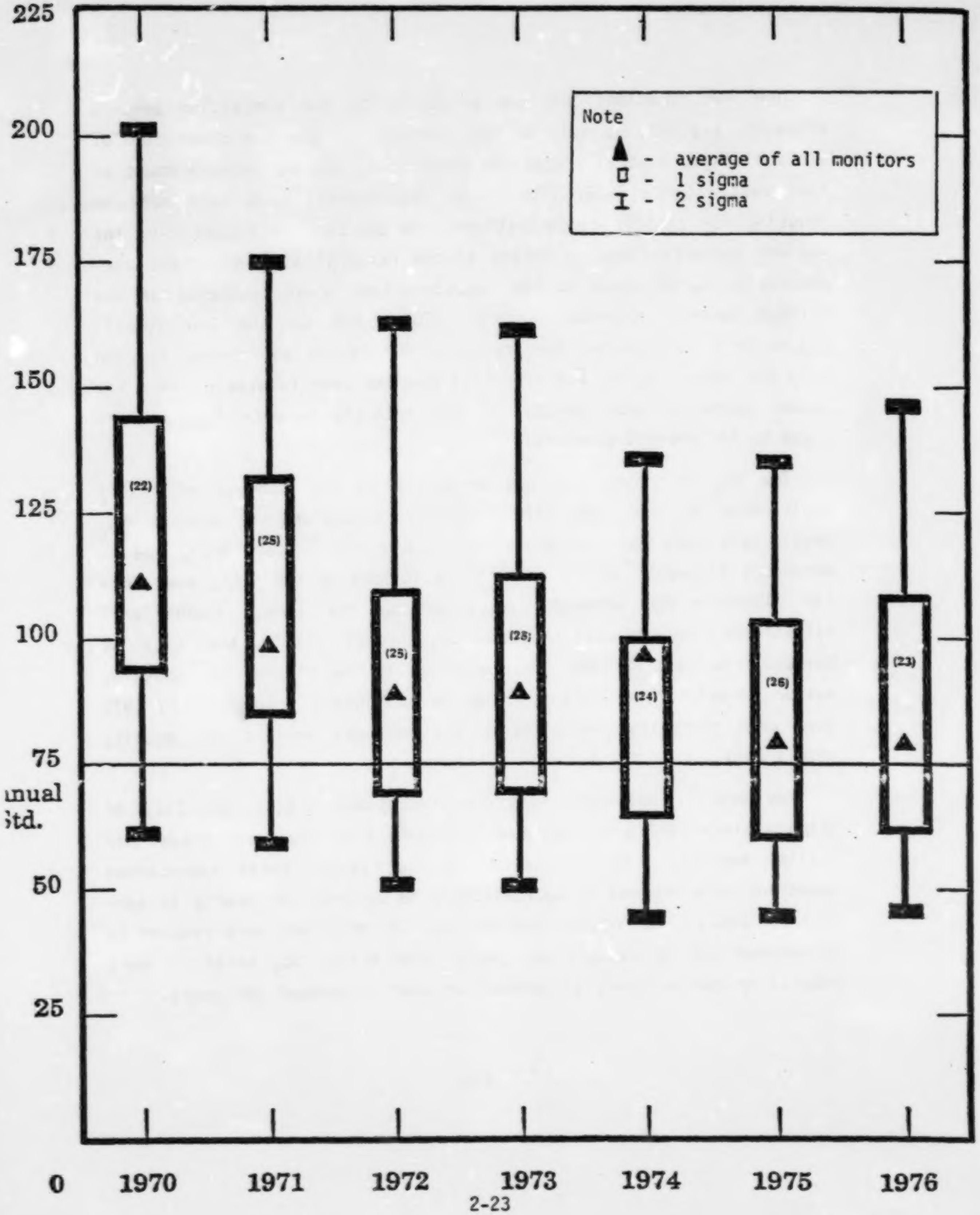
ANNUAL MEAN TSP IN THE CITY OF CHICAGO, 1970, 1976

1970

1976 .

Figure 2-10

Trends in Total Suspended Particulates



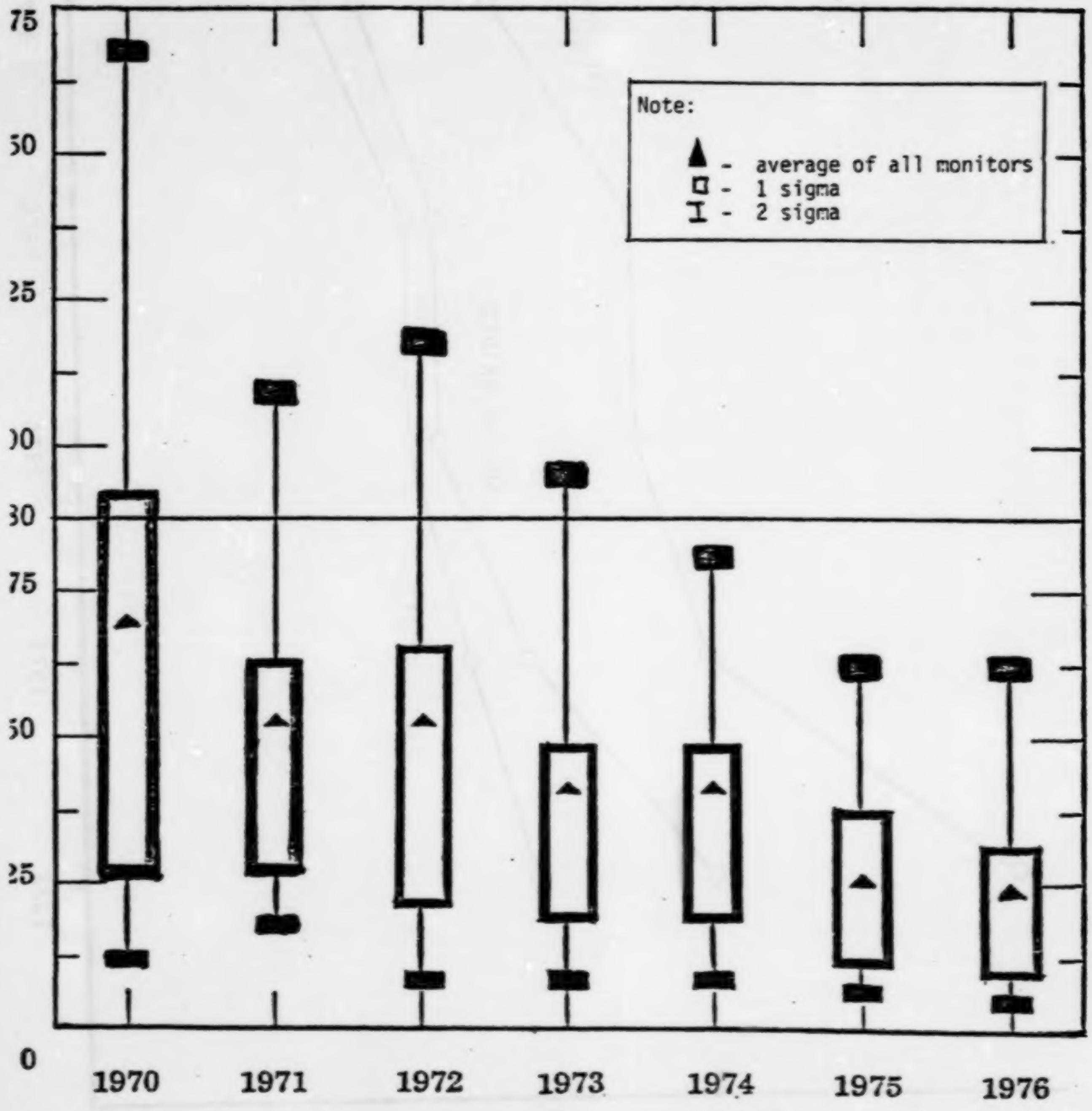
The TSP emissions are due primarily to the combustion process producing fly ash, as well as new construction and the demolition of old buildings, mineral processing operations, and the reintrainment of road dust. Since 1970, significant improvements have been made in reducing TSP ambient concentrations. As depicted in Figure 2-9, the ambient concentrations in excess of the national standards have been reduced primarily down to the industrialized areas southeast of the Chicago Central Business District (CBD), and to the CBD itself. Figure 2-10 illustrates the monitored TSP levels and trends between 1970 and 1976. Again, the overall trend has been favorable, with the annual geometric mean (denoted by the triangle in each figure) very close to the ambient standard.

The SO_2 emissions are due primarily to the burning of fossil fuels such as coal and oil. Dramatic reductions in ambient SO_2 levels have been achieved since 1970 within the Chicago area, due to stringent allowable sulfur content regulations by the CDEC, and similar allowable SO_2 emision limitations by the IEPA. Figure 2-11 illustrates the overall ambient SO_2 trends within the City of Chicago from 1970 to 1976. As indicated in the Figure, the sweeping sulfur emission restrictions placed on stationary sources since 1970 have been successful in bringing the measured ambient air quality levels well within the national standards.

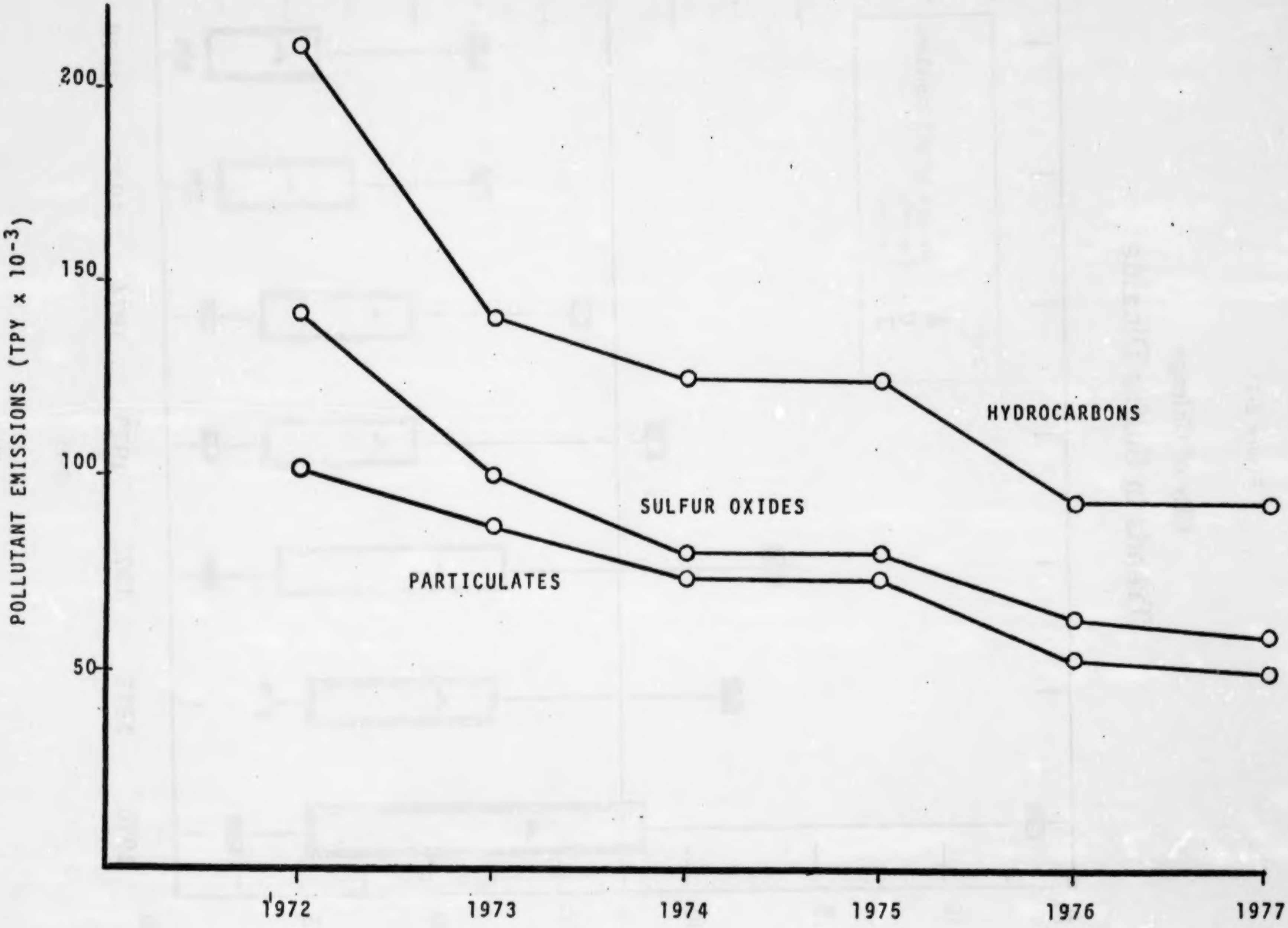
The overall pollutant emissions reductions within the City of Chicago since 1972 are presented in Figure 2-12 (Source: Annual Air Quality Reports). As illustrated in the figure, total hydrocarbon emissions were reduced by approximately 59 percent (or nearly 12 percent per year). During the same period, TSP emissions were reduced by 50 percent (or 10 percent per year). Similarily, SO_2 emissions were reduced by approximately 57 percent (or over 11 percent per year).

Figure 2-11

City of Chicago
Trends in Sulfur Dioxide



(Source: Annual Air Quality Reports)



With respect to stationary source of air pollution, it has been estimated by the IEPA that over 17,000 sources within the State of Illinois are presently identified (i.e., I.D. number and facility name) within the state agency's Total Air System Emission Inventory. Of this total number, approximately 1500-1800 are considered "major" (i.e., potential emissions are equal to or greater than 100 tons per year of any pollutant). Within the City of Chicago, it is estimated that there are approximately 550-600 major stationary sources. Thus, anywhere from 30 to 40 percent of the major stationary sources in Illinois are believed to be located in the City of Chicago.

The Chicago area contains a broad crossection of industrial categories which were targeted for inclusion in this study. The initial industrial category list, which included sixteen source categories, was ultimately trimmed to eleven categories based upon input received from (see Table 2-5), PES targeted for on-site discussions with 20-30 individual facilities. Schedule conflicts and other priorities for the various facilities resulted in PES ultimately visiting 24 facilities. The overall distribution of industrial categories versus individual facility summaries were included in the Chicago Task II Report.

In general, as indicated in the data presented above, the Chicago area has experienced a marked improvement in pollutant emission reductions and associated ambient air quality concentrations during the past several years. These favorable trends (although some non-attainment problems still exist) have been matched with a steady growth in regulatory program activities. The potential relationships between these two areas are explored further in the remainder of this report.

Table 2-5 STATIONARY SOURCE LIST DISTRIBUTION

CATEGORIES	PRIMARY LIST	VISITS COMPLETED	SECONDARY LIST	VISITS COMPLETED	TOTAL
STEAM GENERATORS	4	1	2	2	3
PETROLEUM PRODUCTS AND HANDLING	2	1			1
PRINTING AND PUBLISHING			1	1	1
SECONDARY ALUMINUM	2	1	1	1	2
BRASS AND BRONZE	2	1	2	NONE	1
PETROCHEMICALS	3	3	NONE	NONE	3
MINERAL PROCESSES	2	1	2	2	3
GRAIN HANDLING	1	1	1	NONE	1
LUMBER AND WOOD PRODUCTS	2	1	1	1	2
FOOD PRODUCTS	2	1	1	1	2
SURFACE COATING	5	2	3	3	5
TOTAL SOURCES	25	13	14	11	24

2.3 MAJOR CONTROL AGENCY PROGRAMS AND COSTS

Both the IEPA and the CDEC have developed and maintained a variety of programs intended to bring about initial and continued compliance by stationary sources. For the purposes of this discussion, those agency activities related to assuring initial facility compliance would encompass the "pre-permitting" and "permitting" phases of program operation. These activities related to assuring continued facility compliance (i.e. "enforcement") would encompass the "construction" and "compliance" phases of a program operation.

Both agencies utilize extensive permitting and enforcement functions - the IEPA through its regional office structure backed up by a technically sound headquarters operation; the CDEC through its flexible fleet of mobile inspectors. In general, the IEPA enforcement policies in recent years have tended to favor an approach centered around litigation; while the CDEC approach has tended to concentrate on agency-industry negotiations.

The IEPA permit program involves both a construction permit, as well as a five year renewable operating permit. The agency conducts an extensive New Source Review Program which involves both engineering and dispersion modeling analyses. Enforcement activities of the IEPA include general area surveillance through the regional offices, complaint investigations, Pollution Control Board actions, and legal case preparation in construction with the State Attorney General's office. Although the enforcement-related resources have varied through the years as a function of yearly agency commitments and/or program priorities (such as SIP developmental efforts), the agency has maintained a substantial commitment towards enforcement. As a percentage of overall agency resources the resources devoted to compliance activities have grown from approximately 30 to nearly 70 percent. During the past eighteen months, an increasing level of agency resources have been devoted to SIP development under the Clean Air Act Amendments. Since 1972 overall agency resources devoted to "prevention" (i.e., support engineering functions) has decreased from approximately 50 to 25 percent of overall agency resources.

The CDEC permit system includes an Installation Permit in conjunction with an annual Certificate of Operation (which is coupled with a facility visit). The agency has coupled its permit system with a "sign-off" capacity on all City Building Permits. An engineering review is conducted on all permits, with dispersion modeling used only in special circumstances. Enforcement functions at CDEC include complaints handling, abatement patrols (mobile inspectors), and court case preparation. The CDEC engineering functions include building plan approvals and permits, field surveys, source sampling, and emission inventories. In recent years, over 40 percent of the CDEC resoucrces have been devoted to enforcement/permits/inspections/monitoring activities.

The permit activity levels of both the IEPA and CDEC are controllable only to the extent of scheduling of operating permit/annual certification renewals. In addition, the level of processing/engineering review is somewhat controllable with respect to when extensive dispersion modeling is required in support of a permit application. A 1978 audit of the IEPA New Source Review Program by the EPA regional office indicated that, while the permit program is rather extensive, some further documentation of internal procedures would be beneficial to the agency. Included here was the recommendation to develop a procedure for tracking potential emissions of sources granted construction permits but not yet operating. The CDEC role in actual enforcement efforts is governed somewhat by its role in the SIP, in accordance with its interagency agreement with the IEPA, and its funding conditions with respect to the U.S. EPA.

The IEPA coordinates its case preparation load through staff attorneys assigned to the agency from the Office of the State Attorney General. All prosecutions are handled either by the Office of the Attorney General or the County State's Attorney for the appropriate county involved in the legal proceeding. The CDEC acts through the authority of the Commissioner who can prosecute actions in the name of the City of Chicago.

2.3.1 IEPA STRATEGIES

In terms of program strategies aimed at bringing about initial and continued stationary source compliance, the IEPA and CDEC major programs (identified above) may be characterized as follows. With respect to initial compliance program strategies, the IEPA efforts have been modified since 1971 as a function of environmental priorities and available resources. The "backbone" of the IEPA effort rests in the agency's extensive construction and operating permit system. The program received its greatest effort during 1971-72 as the agency sought to input data on as many sources as possible. In recent years, the system is now an integral part of the IEPA Total Air System which relates permit data to emissions and air quality data. During the 1973-75 time period, the IEPA moved into a phase of more extensive litigation (in conjuncton with the IPCB) in an effort to secure stationary source compliance prior to the May 1975 national target date. Then, during the period of 1976-78, the IEPA entered into a phase of more selective litigation coupled with pre-litigation conferences between IEPA staff and the facility in question.

The strengths of the IEPA effort appear to reside in the fact that the extensive permit program provides a framework for a thorough and comprehensive tehcnical engineering/air quality impact analysis. In addition, the subsequent litigation phase tended to eliminate the potential delays that can be associated with extensive, time-consuming technical negotiations. Finally, the more selective case litigation effort provides for a more effective, less resource-intensive caseload preparation and subsequent actions by the State Attorney General.

The apparent weaknesses in the IEPA initial compliance strategy are that the potentially extensive case backlog may delay ultimate action against recalcitrant facilities by the Attorney General and/or the IPCB. Further, the technically extensive "paper analysis" under the current permit system is resource intensive and may, on occasion, not represent the most efficient use of somewhat limited resources. Finally, the litigation approach utilized by the IEPA tends to remove the agency/facility technical staffs from direct discussion in favor of interactions between IEPA and corporate attorneys. A summary of the IEPA strategies aimed at initial compliance, as well as their associated strengths and weaknesses, are included in Table 2-6.

Regarding strategies aimed at continued compliance by stationary sources, the IEPA effort has centered around two basic activities. From 1974-76 the agency focused on the renewals of the five year operating permits initially issued in 1970-71. The fact that a facility received an initial operating permit has no bearing upon whether or not a renewal permit is issued. The IEPA based most of the decisions upon a technical reassessment of the permit application, coupled with the history of data, related to each particular facility (through malfunction reporting and/or self monitoring requirements). Following the wave of operating permit penalities, the agency shifted its efforts to an expanded surveillance projects from 1976-78. This activity was, for the most part, conducted through the IEPA Regional Office operations.

Table 2-6

STRATEGIES:

1971 - 72	CONSTRUCTION/OPERATING PERMIT SYSTEM
1973 - 75	EXTENSIVE LITIGATION EFFORT
1976 - 78	SELECTIVE LITIGATION EFFORT; PRE-LITIGATION CONFERENCES

STRENGTHS:

- PERMIT PROGRAM PROVIDES THOROUGH ENGINEERING/AIR QUALITY IMPACT ANALYSIS
- LITIGATION APPROACH ELIMINATES POTENTIAL DELAYS ASSOCIATED WITH EXTENSIVE TECHNICAL NEGOTIATIONS
- SELECTIVE CASE PREPARATION FACILITATES CASE LOAD ACTIONS BY ATTORNEY GENERAL

WEAKNESSES:

- POTENTIAL CASE BACKLOG DELAYS ULTIMATE ACTION AGAINST RECALCIITRANT FACILITIES
- EXTENSIVE "PAPER ANALYSIS" UNDER PEMIT SYSTEM IS RESOURCE INTENSIVE
- LITIGATION APPROACH REMOVES TECHNICAL STAFF FROM DIRECT DISCUSSIONS IN FAVOR OF ATTORNEY INTERACTION

ILLINOIS EPA: INITIAL COMPLIANCE STRATEGIES

The strengths of the IEPA strategy are that the five year operating permit renewal effort assures that at least a partial reinvestigation of all facilities occurs with regard to continued compliance. Further, the IEPA Regional Office structure enhances state interactions and responsiveness with respect to facilities in the field. Finally, the effectiveness of the renewable operating permit system appears to be enhanced when used in conjunction with selective source testing and/or on-site inspections.

The apparent weaknesses associated with the IEPA continued compliance strategy are that the initial five year operating permit renewals were not properly scheduled. The result was that the agency was receiving several thousand permit applications per month during the renewal period, with a 90 day permit processing time allowed prior to issuance by default. The agency was therefore hard-pressed to provide a complete, thorough analysis of all renewal applications that were received. Further, there were no specific provisions for facility periods between initial issuance and renewal of operating permits. Most interactions appeared to occur as the result of malfunction reports and/or other specific complaints. Finally, it appears that the regional office staffing was to "thin" to provide for extensive facility surveillance. With 500-600 major sources in the Chicago area alone, the Maywood Regional Office has operated in a staffing range of 15-20 people for air programs. However, the office is responsible for nineteen counties, an average of approximately one person per county. A summary of the IEPA strategies aimed at continued stationary source compliance is provided in Table 2-7.

2.3.2 CDEC STRATEGIES

The CDEC has developed and maintained several programs intended to assure the initial compliance by staionary sources. The framework of the CDEC strategy is centered around the agency's construction permit system. This system, combined with the agency's annual certificate of operation is intended to provide broad coverage of any new or existing

Table 2-7

STRATEGIES

1974 - 76	OPERATING PERMIT SYSTEM (PREMIT RENEWALS)
1976 - 78	REGIONAL OFFICE OPERATIONS (SURVEILLANCE)

STRENGTHS

- FIVE YEAR OPERATING PERMIT RENEWAL ASSURES PARTIAL RE-INVESTIGATION OF FACILITIES FOR CONTINUED COMPLIANCE
- REGIONAL OFFICE STRUCTURE ENHANCES STATE INTERACTIONS WITH FACILITIES
- RENEWABLE PERMIT SYSTEM MAY BE USED IN CONJUNCTION WITH SELECTIVE SOURCE INSPECTIONS TESTING

WEAKNESSES:

- FIVE YEAR PERMIT RENEWALS NOT PROPERLY SCHEDULED - ALL APPLICATIONS DID NOT RECEIVE THOROUGH REVIEW
- NO SPECIFIC PROVISIONS FOR FACILITY SURVEILLANCE DURING "OPEN" PERIODS BETWEEN PERMIT RENEWALS
- REGIONAL OFFICE STAFFING TOO "THIN" FOR EXTENSIVE FACILITY SURVEILLANCE

ILLINOIS EPA: CONTINUED COMPLIANCE STRATEGIES facilities in the City of Chicago. Further, the agency has coupled these procedures with an informal policy aimed at securing stationary source compliance through continued interaction and negotiation, rather than through litigation.

The inherent strength of the CDEC program is that the agency's construction permit program is interfaced with the City Building Permit Requirements, thereby, providing for strong coverage of new construction. In addition, the CDEC operates the permit program in conjunction with a rather thorough, annual (quasi-scheduled) facility inspections usually with 1 - 2 days prior notice. Finally, the negotiation policy brings the environmental engineers for the regulatory agency and the affected facility together. This technique may be potentially less time consuming than litigation when technology-forcing pollution control issues are involved.

The apparent weaknesses of the program relate to the seeming lack of written, established technical guidelines for the engineering permit review. Consistency and quality of review is dependent on "quasi-formal" interaction amongst CDEC staff. Further, the mandatory annual reinspection of all facilities may not be as cost-effective as the more selective inspection of major polluters. Finally, it is noted that failure of the negotiation policy may mean substantial time and effort during the process, with the end result being compliance pursued through litigation. A summary of the CDEC strategies aimed at securing initial stationary source compliance is provided in Table 2-8.

The CDEC maintains several interrelated activities intended to provide continued stationary source compliance. First, as discussed previously, the agency operates a rather extensive annual facility inspection process which is coupled with the annual certificate of operation. The agency reinforces this program with a large fleet of

Table 2-8

STRATEGIES:

- CONSTRUCTION PERMIT SYSTEM
- ANNUAL CERTIFICATE OF OPERATION
- NEGOTIATION vs. LITIGATION

STRENGTHS

- CITY BUILDING PERMIT REQUIREMENT TIED TO CONSTRUCTION PERMIT REVIEW BY DEC
- THOROUGH, ANNUAL QUASI-SCHEDULED INSPECTIONS OF FACILITIES (1-2 DAYS PRIOR NOTICE)
- NEGOTIATION APPROACH BRINGS ENGINEERS TOGETHER; POTENTIALLLY LESS TIME-CONSUMING THAN LITIGATION

WEAKNESSES:

- LACK OF ESTABLISHED GUIDELINES FOR ENGINEERING PERMIT REVIEW
- ANNUAL REINSPECTION OF ALL FACILITES MAY NOT BE AS COST-EFFECTIVE AS SELECTIVE INSPECTIONS
- FAILURE IN NEGOTIATION PROCESS MEANS TIME LOST - MUST THEN BE PURSUED THROUGH LITIGATION

CHICAGO DEC - INITIAL COMPLIANCE STRATEGIES mobile inspectors. Five inspectors not only provide for the scheduled inspections, but also provide rapid-response complaint handling capability. Finally, the effectiveness of the overall mobile fleet is enhanced as the city inspections are authorized to issue tickets for recorded violations. In the last two years, 1977 and 1978 a total of 1,440 and 1,378 tickets were issued for the respective years. The corresponding fines assessed were $45,555 and $34,420.

The strengths of the CDEC program are that the roving inspectors provide an effective, quick-response mechanism for surfacing immediate visible emissions and/or equipment malfunction violations. Also, the annual reinspection of all facilities is thorough in that all sources are assured of receiving a regular, periodic review of performance. Finally, the ticketing process represents a rapid-response enforcement tool, which can serve to speed the actions necessary in moving the violating source into court.

The apparent weaknesses of the CDEC program are that the roving inspectors may be limited primarily to TSP or visible emission violations. That is, the mobile inspector system may not be as effective in following up on HC of SO_2 emission violations. Also noted as a weakness was the fact that the record-keeping requirements (with respect to both the CDEC inspectors and the facility operators) is not as efficient as possible, which may tend to negate the full impact of the annual inspections. Finally, the amount of the fines levied through the ticketing system may not be significant enough to serve as a preventive mechanism. Violations are considered as misdemeanors, with fines of $100 - $300 for first offenses, and $300 - $500 for subsequent offenses. A summary of the CDEC programs aimed at continued compliance by stationary sources is included in Table 2-9.

2.3.3 CONTROL PROGRAM COSTS

The basic program cost elements for the statewide IEPA program for fiscal years 1974 - 1978 were depicted in Table 2-1. As indicated in the Table, the program elements listed were "Compliance", "Prevention", "Assistance", "Grants", "Emergency Response", and "Administration". For the purposes of relating only those program costs

Table 2-9

STRATEGIES:

- ANNUAL FACILITY INSPECTIONS
- MOBILE INSPECTOR SYSTEM
- TICKETING SYSTEM

STRENGTHS:

- ROVING INSPECTORS EFFECTIVE IN SURFACING IMMEDIATE VISIBLE EMISSIONS/EQUIPMENT MALFUNCTION VIOLATIONS
- ANNUAL REINSPECTION OF ALL FACILITIES IS THOROUGH IN THAT ALL FACILITIES ARE REVIEWED PERIODICALLY
- TICKETING PROCESS RESPRESENTS QUICK-RESPONSE ENFORCEMENT TOOL; CAN SPEED ACTION TOMOVE VIOLATOR INTO COURT

WEAKNESSES:

- ROVING INSPECTORS NOT EFFECTIVE IN IDENTIFYING VIOLATORS FOR POLLUTANTS OTHER THAN TSP
- LACK OF EFFECTIVE RECORD-KEEPING REQUIREMENT TENDS TO NEGATE FULL EFFECT OF ANNUAL INSPECTIONS
- AMOUNT OF FINE MAY NOT BE SIGNIFICANT ENOUGH TO SERVE AS PREVENTIVE MECHANISM ($100-$300/300-$500)

CHICAGO DEC - CONTINUED COMPLIANCE STRATEGIES aimed at initial and continued stationary source compliance for sources in the Chicago area, two assumptions have been made. First, that the bulk of the IEPA expenditures in the program areas of interest are embodied in the "Compliance" and "Prevention" categories. It is realized that a slight portion of the costs are also included under "Administration" and "Emergency Response". However, the portion of the costs associated with the former category are not considered to be directly related to source compliance as the IEPA defines "Administration" primarily as internal operations. Further, the funds associated with this category have remained generally constant over time, and less than ten percent of the overal IEPA expenditure. Similarily, the costs associated with "Emergency Response" are primarily episode related, and not necessarily tied to initial or continued compliance with established emission limitations. Further, the category has also remained relatively constant over time and less than five percent of the overall program.

To relate the IEPA statewide expenditures to those costs relative to the City of Chicago, PES has assumed a proportionate relationship between the number of major sources statewide and the number of such sources in Chicago. As mentioned in an earlier discussion, there are approximately 17,000 sources on record statewide at the IEPA. Of this total, approximately 1500 - 1800 are considered major sources. Within the statewide amount, approximately 550-600 sources are located in Chicago. Thus the approximate percentage of Chicago sources to the total statewide estimate is 30 - 40 percent (or an average of 35 percent).

The total IEPA program expenditures in Chicago have been derived from the two key program categories listed in Table 2-1 and adjusted down by the 35 percent factor. These costs are reflected below in Table 2-10, with all costs rounded to the nearest $1,000 increment.

Table 2-10 IEPA PROGRAM CATEGORY COST ESTIMATES
IN THE CITY OF CHICAGO
(Air Pollution Programs)

Program Category	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79
Compliance	$263,000	$403,000	$358,000	$502,000	$ 897,000	$ 961,000
Prevention	412,000	432,000	452,000	365,000	327,000	341,000
Total	675,000	835,000	810,000	867,000	1,224,000	1,302,000
Total (1978 Dollars)	$852,000	$994,000	$910,000	$919,000	$1,224,000	$1,228,000

With respect to the CDEC program expenditures, the overall cost data were presented by program elements for fiscal years 1974-78 in Table 2-2. For the purpose of relating CDEC expenditure to those programs aimed at bringing about initial and continued stationary source compliance, only those program elements entitled "Enforcement Services", "Engineering Services", and "Inspectional Services" have been considered. The remaining category, "Technical Services" (as discussed earlier in this Section) relates primarily to ambient monitoring and laboratory services. The enforcement, engineering and inspectional services include the mobile inspectors, permits, source testing, annual inspections, and all engineering analyses.

The total CDEC program expenditures derived from the three key program elements are presented in Table 2-11 below, for fiscal years 1974-78. The costs have been adjusted to constant 1978 dollars. All CDEC costs include city as well as Federal Section 105 funds.

Table 2-11 CDEC PROGRAM CATEGORY COST ESTIMATES
IN THE CITY OF CHICAGO
(Air Pollution Programs)

Program Category	FY 74	FY 75	FY 76	FY 77	FY 78
Enforcement Services	$469,930	$543,379	$ 575,212	$ 664,491	$597,813
Engineering Services	239,807	259,642	337,613	287,063	304,984
Inspectional Services	55,088	56,117	60,784	68,340	73,173
Total*	765,000	859,000	974,000	1,020,000	976,000
Total (1978 Dollars)	$966,000	$1,023,000	$1,094,000	$1,081,000	$976,000

* Total costs have been rounded to the nearest $1,000 increment.

In order to estimate the IPCB expenditures within the City of Chicago several assumptions have been made. First, that the total statewide IPCB expenditures may be proportioned by pollutant media (i.e., air, water, solid waste, etc.) on the basis of the number of board's action in each area (as reflected in Tables 2-3 and 2-4). Further, that the estimated IPCB statewide air pollution-related expenditures can be adjusted to reflect Chicago-based activities using the proportion of major stationary sources in Chicago to the total statewide estimate. While it is recognized that some inherent weaknesses exist in this approach, since all case load activities are not equal with respect to resource intensiveness nor are the cases necessarily evenly distributed across the sate, the above techniques offers an average relative approximation of Chicago versus statewide program costs. The IPCB program cost estimates relative to stationary source compliance in Chicago are listed in Table 2-12 below. Costs have also been adjusted to reflect constant 1978 dollars.

Table 2-12 IPCB PROGRAM COST ESTIMATES IN THE CITY OF CHICAGO

Fiscal Year	1973	1974	1975	1976	1977	1978
Total (Statewide)	$668,700	$579,900	$638,500	$627,400	$574,900	$609,500 (Est.)
Total (Chicago)*	$ 95,490	$111,630	$103,916	$ 68,732	$ 30,182	$ 42,665
Total (1978 Dollars)	$128,000	$141,000	$124,000	$ 77,000	$32,000	$42,665

* Total statewide costs have been proportioned on the basis of air program case load to total case load for a given year, and then further adjusted by the 35 percent factor of major Chicago sources to the statewide total. The case load adjustment values for the various fiscal years (i.e., air cases/total cases) are: FY 73 - 40.8 percent; FY 74 - 55 percent; FY 75 - 46.5 percent; FY 76 - 31.3 percent; FY 77 - 15 percent; FY 78 - 20 percent (est.).

The total program costs for the IEPA, IPCB and the CDEC relative to stationary source compliance within the City of Chicago are plotted in Figure 2-13 (1978 dollars). In addition, using the pollutant emission reduction trend information provided in Figure 2-12, an approximation may be made of the aggregate pollutant emission reductions that have occurred compared to the control agency program expenditures over time. It should be noted, however, that such estimates cannot be considered as a comprehensive cost-benefit analysis, since the stationary source costs, nor the health-related benefits are beyond the scope of this study. The cost-emission reduction summary is presented in Table 2-13.

Data regarding control agency program costs on a "per source" basis are provided in Table 2-14. The costs are calculated on the basis of 1978 constant dollars, with program costs divided by the approximate number of major sources in Chicago (i.e 550 sources). As indicated in the Tables, while the average program costs per ton of pollutant emission reduction achieved had increased over time as a function of diminishing marginal returns, the average cost per facility of the agencies has remained relatively constant during the past five years, (even though the relative program costs between agencies have varied with time).

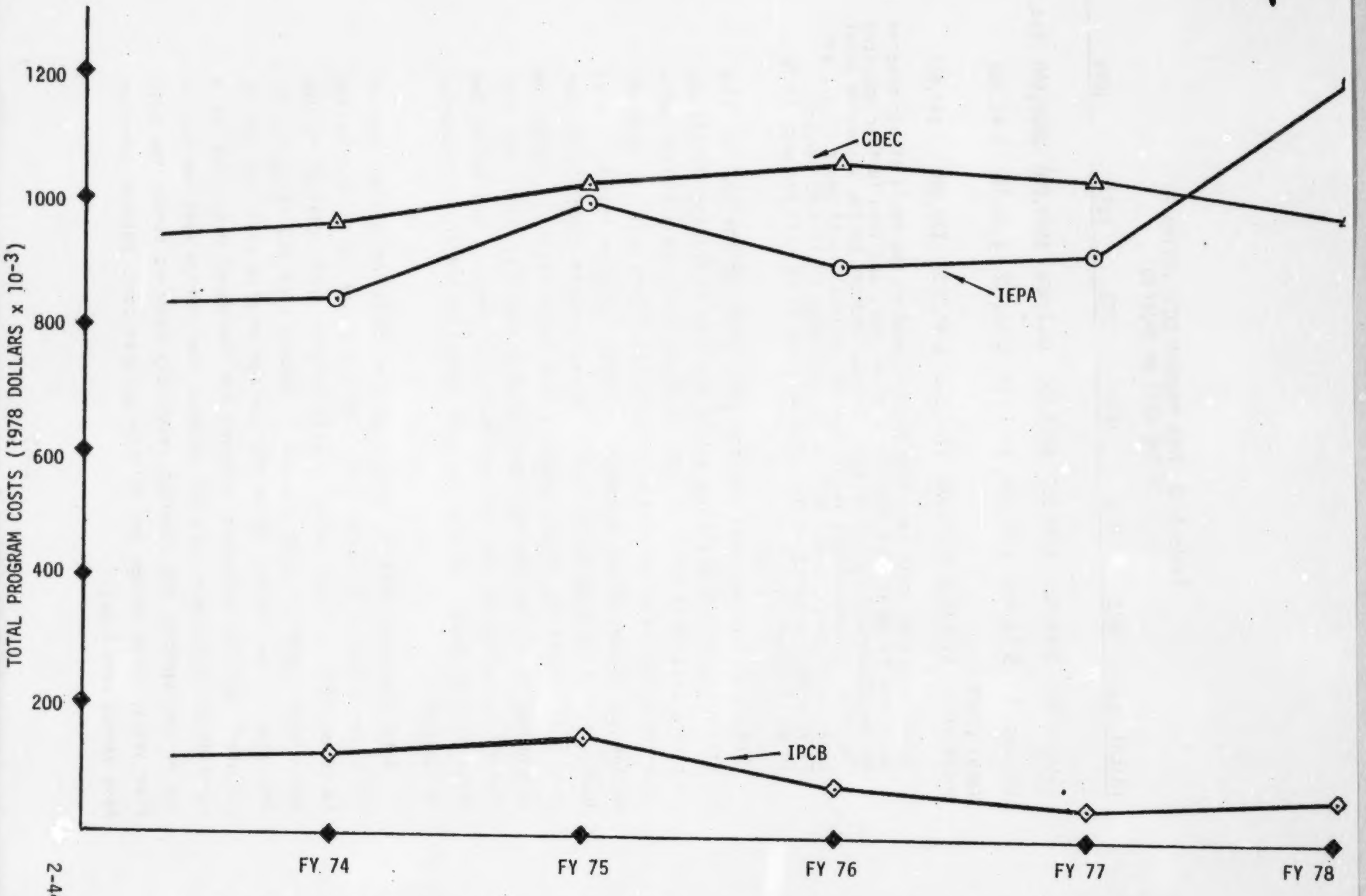


Figure 2-13. STATIONARY SOURCE AIR POLLUTION CONTROL PROGRAM COSTS COMPARISON CITY OF CHICAGO

Table 2-13 AGGREGATE COST - AIR EMISSIONS REDUCTIONS SUMMARY

YEAR	TOTAL AIR POLLUTANT REDUCTION*	IEPA COST/TON**	CDEC COST/TON**	IPCS COST/TON**
FY 74	130,860 TPY	$ 6.51/Ton	$ 7.38/Ton	$1.08/Ton
FY 75	50,303 TPY	19.76/Ton	20.37/Ton	2.47/Ton
FY 76	Negligable	-	-	-
FY 77	63,995	14.36/Ton	16.89/Ton	0.51/Ton
FY 78	4,305 TPY	284.32/Ton	226.71/Ton	9.91/TOn

* Pollutant emission reductions are a composite of TSP, SO_2 and HC reductions for a given fiscal year (see Figure 2-12)

** All costs represent the average total cost per ton of air pollutant reduced or removed

Table 2-14 AVERAGE AIR POLLUTION CONTROL PROGRAM COSTS PER MAJOR STATIONARY SOURCE

YEAR	FY 74	FY 75	FY 76	FY 77	FY 78	AVERAGE
IEPA	$1,549/Source	$1,807	$1,655	$1,671	$2,225	$1,781
CDEC	1,756	1,860	1,989	1,965	1,775	1,869
IPCB	256	225	140	58	78	151
AVERAGE	$1,187	$1,297	$1,261	$1,231	$1,359	$1,267

* All costs listed are costs for control agency air programs and do not consider costs included by the individual sources

2.4 STATIONARY SOURCE COSTS

The stationary cost data regarding capital and operating expenditures incurred by facilities in complying (or attempting to comply) with applicable regulations were gathered where available during the facility visits. As dicussed in the conclusions of the Task 2 Report, the cost data compiled indicated a broad range of costs as a function of the size of the industry, the pollutant included, the nature of the process or operation to be controlled, and the type of control technology that had to be applied. Generalizations across or within specific source categories are difficult at best, due to the extreme variety of case histories involved coupled with the relatively small sample of facilities. The apparent reasons for economic variability are thus based upon the following factors:

- Facility Involved
  - Size of Facility
  - Age of Facility/Process
  - Pollutants Emitted
  - Space Limitations
- Process to be Controlled
  - Equipment Design
  - Throughput Rates
  - Material Recoverability Potential
  - Original Process Capital/Operating Costs
  - Process Profit Margin
- Control Equipment
  - Availability
  - Technological Development Stage
  - Equipment Suppliers
  - Equipment Guarantees (or Lack Thereof)
  - Equipment Reliability
  - Equipment Capital/Operating Costs
  - Installation Schedule/Requirements

With respect to the specific industry categories reviewed during Task II of the study, the greatest control cost variability appeared to occur in the Chemical Industry, due to the wide variety of processes/pollutants involved. Table 2-15 presents a facility-special overview of control costs. The table identifies the industry category reviewed, as well as the control technique and pollutant involved. The data base is too limited to provide any meaningful estimate of control costs within a specific source category. However, an extremely gross estimate may be made regarding average control costs (capital costs only) across all facilities covered and encompassing all pollutants of interest (i.e. TSP, SO_2, HC). This composite figure must be considered with caution due to the limited number of sources and available cost data. For the facilities reviewed in this study, the average capital costs per facility were $400,000 to $500,000.

2.5 CONCLUSIONS

An analysis of the emission reduction trends data indicates that progress has definitely been made in reducing pollutant levels in the City of Chicago. The figures illustrating the measured ambient air quality data trends reaffirm the conclusion that overall progress has been achieved. Further by examining the state/local control agency program expenditures over the past several years, and by coupling this review with the data gathered regarding stationary source control equipment expenditures over time, clearly indiates that some definite relationship exists between the control agency and the affected stationary sources. The fact that substantial funds have been invested by both the control agencies (approximately $1,300 per source) in the stationary sources abatement-related activities and (approximate average capital investment per facility of $400,000) indicates that the environmental control working relationship is relatively strong between government and industry. Finally the fact that the stationary sources have maintained an average continuous compliance rate of 79 percent (over the sample studies) indicates that the control agency/industry relationship has been generally effective in bringing about initial and continued compliance. In this context, "compliance" is defined as achieving and maintaining emission levels

Table 2-15. AIR POLLUTION CONTROL EQUIPMENT - COST AND PERFORMANCE

INDUSTRY CATEGORY	CONTROL	COST	POLLUTANT	AGE	TIME EQUIPMENT IN COMPLIANCE	APPROXIMATE ANNUAL OPERATING COSTS **
Steam Generator	Fuel Conversion	N/A*	TSP, SO_2	15 yr	100	N/A
Steam Generator	Fuel Conversion Baghouse	N/A $2,500	TSP, SO_2	15 yr	100	N/A
Steam Generator	Fuel Conversion	$350,000	TSP, SO_2	9 yr	100	$20,000-$40,000/unit
Petroleum Products	Submerge-fill System	N/A	HC	8 yr	100	$10,000-$20,000/facility
Printing/ Publishing	Afterburner ESPs Solvent Reformulation	$156,000+	TSP, HC	1-10 yr	50 (HC) 0 (TSP)	$20,000-$30,000/facility
Secondary Aluminum	Baghouse Afterburner	$1,200,000	TSP	1-8 yr	12	$50,000-100,000/facility
Secondary Aluminum	Cyclone Afterburners Baghouse	N/A	TSP	1-15 yr	98	N/A
Brass/Bronze	Baghouse	N/A	TSP	7 yr	100	N/A
Chemical	Scrubbers Aerators Air Condensers	$1,800,000	HC, odor	18 yr	0	N/A
Chemical	Baghouse Wet Cyclone	$11,863 29,200	TSP	24 yr	100	$15,000-$20,000/process
Chemical	Incinerator Baghouse	$329,000 8,800	TSP,HC	6 yr	100	N/A
Chemical	Scrubbers Condensers Cyclone	$136,500	HC	1-40 yr	88	N/A

* N/A = Not Available

** Includes abatement-related O & M costs

Table 2-15. AIR POLLUTION CONTROL EQUIPMENT - COST AND PERFORMANCE

INDUSTRY CATEGORY	CONTROL	COST	POLLUTANT	AGE	TIME EQUIPMENT IN COMPLIANCE	APPROXIMATE ANNUAL OPERATING COSTS **
Mineral Processes	Baghouse	$373,700	TSP	5 yr	60	$20,000-$30,000/facility
Mineral Processes	Baghouse	N/A	TSP	8 yr	100	N/A
Grain Handling	Baghouses	$4-$5,000,000	TSP	1-12 yr	100	$15,000-$50,000/facility
Lumber/Wood Products	ESPs Filters Cyclone		TSP,HC	1-5 yr	12	N/A
Lumber/Wood Products	Exempt Solvents	N/A	HC	2 yr	100	N/A
Food Products	Cyclone, wet-- Baghouses--	N/A $46,000+/unit	TSP	30 yr	100	$6,000-$10,000/unit
Food Products	Fuel Conversion		TSP,SO_2	1-8 yr	100 (SO_2) 12 (TSP)	N/A
Surface Coating	Afterburner Exempt Solvents	+$302,000	HC	3 yr	100 (1976)	$50,000-$100,000/facility
Surface Coating	Scrubber Exempt Solvents	$461,000	HC,odors	4-5 yr	100 (HC)	$100,000-$250,000/facility
Surface Coating	Solvent Reformulation Baghouses Cyclones Scrubbers	N/A	TSP,HC	4 yr (solv)	85-100	N/A
Surface Coating	None	N/A	HC	N/A	N/A	N/A

which are consistent with applicable emission limitations. In the following sections, we will examine the agency/industry relationship more closely and will assess the potential for developing a regulatory framework potentially more effective and efficient (in terms of stationary source compliance) than the system currently in practice.

3.0 SOURCE RESPONSE FACTORS AND COMPARISONS

3.1 INTRODUCTION

3.1.1 SOURCE SELECTION METHODOLOGY

During the Task I study, a preliminary list of candidate facilities was prepared. This list was compiled during the process of probing the IEPA/CDEC regulatory programs, and was modified in-part based upon input and recommendations received from both agencies in conjunction with the EPA and CEQ Project Officers. Based on source type availability, 11 source categories for the Chicago case study were chosen. Additional criteria for source selection included facility size, pollutant emissions, available data base, compliance track record, and current compliance status.

As would be expected, PES was not able to visit each of the initially identified facilities (due to schedule conflicts, other priorities for the facility, no desire to participate in the study, etc.). Therefore, additional facilities were selected, in keeping with the above-referenced criteria. The target facility categories, the initial source distribution, and the listing of the facility types ultimately visited by PES are summarized in Table 3-1. Overall, PES targeted for the review of 20-30 sources in the Chicago case study. As indicated in the table, the ultimate result was 23 inspections which constituted the best mix of sources available considering sizes, ownership, pollutant, data availability, compliance history, and methods of control.

The process for conducting the facility visits was initiated at an early stage in the project, in order to provide for an orderly transition from Task I to Task II. Preparations for Task II involved the development and refinement of the facility checklist. In preparing for the facility inspecting sources with respect to compliance with applicable pollution control regulations.

Table 3-1 STATIONARY SOURCE LIST

CATEGORIES	VISITS COMPLETED	EMISSIONS CONTROLLED	TYPE OF CONTROLS
Steam Generators	3 1	TSP, SO_2 TSP, SO_2	Baghouse Fuel Conversion
Petroleum Products and Handling	1	TSP, SO_2, HC	Submerge Fill Systems
Printing and Publishing	1	TSP, HC	Afterburner, Baghouse Precipitator, Filtration Solvent Reformulation
Secondary Aluminum	2	TSP, HC	Afterburner, Baghouse Cyclone, Scrubber
Brass and Bronze	1	TSP	Baghouse
Petrochemicals	4	TSP, HC	Baghouse, Cyclong Scrubbers, Condensors Incinerator
Mineral Processes	2	TSP, Fugitive Dust	Baghouse
Grain Handling	1	TSP Fugitive Dust	Baghouse, Covered conveyors, Transfer Points
Lumber and Wood Products	2	TSP, HC	Cyclone, Electrostatic Precipitator, Filters Scrubber/Filter, Solvent Reforumulation (painting)
Food Products	2	TSP	Cyclone, Baghouse
Surface Coating	4	HC, TSP	Solvent Reforumulation, Scrubber, Afterburner, Cyclone Baghouse

Task II was initiated with the preparation of an introductory letter which was to be sent to each representative facility owner/operation. The content of the letters was critical as the letter had to: solicit the cooperation of the facility owner in the study; assure the anonymity of all data gathered during and subsequent to the visit; and provide the facility operator with sufficient input data in order to prepare effectively for the PES visit. Each letter was accompanied by a copy of any introductory memorandum prepared by the CEQ Project Officer. as well as a copy of the facility checklist.

PES also solicited the assistance of the Chicago Association of Commerce and Industry (CACI) in order to reinforce our efforts at securing industrial support for the study. As a result, the CACI environmental committee drafted a letter to all facilities which, at that time, were still reluctant to participate in the study. The CACI effort was successful in elevating the level of participation from 35 to 80 percent of the facilities initially contacted.

Once the facility visit were scheduled, additional copies of the facility checklist were furnished to the owner-operator in order to fully prepare all meeting participants. Following the facility visits, all data gathered were analyzed and compared to the data compiled from control agency files on each facility prior to the on-site visit. Any discrepancies, apparent errors, or missing data required a recontact of either the control agencies, the facility, or both for more information.

In the following pages, we summarize our Task II report in terms of source interaction with the regulatory agencies (CDEC and IEPA), control equipment histories, applicable emission profiles, source decision-making processes, the comparison of sources within generic categories, and the comparison of source across generic categories. In all cases, dollar figures have been converted to 1978 values. For additional information, please refer the Task II report.

Factors which influence a source's ability to achieve compliance may be of a technical nature, non-technical nature, or, more commonly, a combination of both. The selection and effective implementation of a specific control method is dependent upon the following technical considerations: identification and verification of proven technology for the particular process point source to be controlled; the size or throughput of the operation (i.e., sizing of the control device); and the age of the affected facility (ie. the ability to retrofit the existing process with suitable contro devicesl).

Non-technical factors which affect the time span between the detection of a problem and the required remedial action to correct a violation of emission standards are, for the most part, traced to regulatory and source-vendor interactions. For instance, the sources' response time to a notice will usually vary according to the degree to which the regulatory agencies pursues the matter. An indication of the agency's attitude or posture concerning a violating source is the frequency of interaction with the source as well as the manner in which the control agency chooses to wield its regulatory authority.

The CDEC favors constant interaction and monitoring of source progress throughout the initial compliance planning and attainment periods. Through intimate knowledge of facility progress, the city agency can substantiate non-regulatory delays such as those encountered in contract negotiations, engineering design problems, purchase and ordering of equipment, component deliveries/availability and installation, and fund raising. Vendor related delays often occur due to strikes and unfavorable weather conditions. Additionally CDEC closely monitors the "re-attainment" of compliance conditions following malfunctions. (The reporting of malfunction situations is required of the source.)

The IEPA, on the other hand, tends to favor the issuance of an order which legally binds a source to comply with applicable regulations within a specified period of time. Accompanying this time frame are milestone dates which prescribe incremental steps towards compliance.

3.2 AGENCY INTERACTION

The reasons for facility compliance may be technical, non-technical, or a combination of both. The technical reasons for compliance are dependent upon: available "proven" technology for a given process/pollutant; the size or throughput of the operation (i.e., cost and economics of installation); the age of the facility (i.e., ability to retrofit; technical feasibility); lead times for control equipment selection/performance verification, design, ordering, delivery and installation; and the availability of control equipment suppliers.

The non-technical reasons for compliance (or non-compliance) are more closely related to regulatory agency actions than activities specific to a particular source category. That is, the reasons for compliance expressed by industry appeared to be a function of the type of action or policy adopted by the respective regulatory agencies. It is the effectiveness of the regulatory agency's action or policy that will determine the willingness (or reluctance) of a source to enter into a compliance program

The CDEC permit system includes an Installation Permit with an annual Certificate of Operation. Annual inspections of the affected facility are always made and the present state of compliance is determined before the issuance of the Certificate of Operation. The agency has also coupled its permit system into a "sign-off" capacity on all City Building Permits to insure issuance of an Installation Permit prior to commencement of construction/major modification of a facility. A non-complying source may also be brought to CDEC's attention by the complaint handling procedure and by the constant surveillance by the mobile inspectors. Sources in apparent non-compliance (i.e., complaint under investigation or ticket pending) would not have their annual Certificate of Operation issued until compliance is achieved. Demonstration of compliance by performance of a stack test may be required for either the initial Certificate of Operation or for any renewal. The actual requirement of a stack test is made on a case-by-case basis. The CDEC's annual inspections enhance continual compliance and subsequent certificate renewal.

The IEPA permit system involves both a construction permit and a five year renewable operating permit. IEPA inspections of large sources (i.e. greater than 100 TPY potential emissions) are done on an annual basis with periodic inspections conducted in response to complaints to the regional office. Process modifications require permits and source testing prior to start-up to insure compliance.

Both the CDEC and the IEPA permit systems appear to be highly effective in bringing a new or existing source into initial compliance. In some cases, a facility (such as in the brass/bronze category) was more apt to enter into a permit system compliance program as a result of agency pressure to do so. The cooperation was a result of a good working relationship between the facility and the control agency. Other facilities entered into the permit systems on their own initiative (such as in the grain handling, food processing categories) prior to being approached by the control agency. The annual renewal of the CDEC Certificate of Operation is effective (i.e. No Certificate of Operation will be issued to non-complying sources. Without a Certificate of Operation, the source is subject to daily fines for operating and can be shutdown through the CDEC's sealing authority.) in the continual compliance of a source whereas the IEPA system (five year permit renewal) is more dependent on such factors as complaint responses and facility process modification inspections for assuring the continued compliance of a source. For the facilities investigated, IEPA permit renewals appeared to be granted with no major problems. Exceptions were chemical facilities for which the renewal of the operating permits were denied on the basis that the sources were petrochemical processes and were subject to limitations of a more stringent regulation. Subsequently, affected sources petitioned the IPCB for a rule change.

The IEPA appears to be passive with small sources operating with a valid CDEC Certificate of Operation (such as in the surface coating category). In other words, the IEPA appears to concern itself more with the administrative compliance (i.e. obtaining proper permits) of the source and allows the CDEC to concern itself with the enforcement of emission compliance for smaller facilities. There was substantial interaction noted in the instance involving surface coating operation, with the CDEC closely monitoring the process to be permitted.

For the large facilities (usually over 100 TPY), the IEPA takes a more active role in the enforcement of emission limitations. The CDEC may be active in surveillance of the facility, which may result in a violation notice and a subsequent fine, but the source's incentive to comply is based mainly on IEPA pressure to do so (i.e. through enforcement or litigation).

Where visible emissions are concerned, there is a more instantaneous interaction with the source and the CDEC than with the IEPA. This is due to both citizen nuisance complaints being filed promptly with the CDEC, and the constant surveillance by the CDEC mobile inspectors. Notice of violations may be issued immediately and a fine may result in immediate efforts to comply (as noted in the mineral and printing categories). In these cases, the facility took steps toward compliance after the notice of violation or initiation of enforcement/legal proceedings.

In some cases (i.e. the lumber/wood processing, secondary aluminum and chemical manufacturing categories), the source felt that it had its best working relationships with the CDEC. The sources noted that rather than taking direct enforcement actions, the CDEC monitored progress by maintaining constant interaction with the source. The IEPA tended to favor legal enforcement procedures.

If the control agencies were passive in their enforcement actions toward a source (as noted in the lumber and wood products categories where control equipment was designed as an add-on to the existing facility process), the source would develop a low-level exploratory compliance program in order to select the least costly control alternative.

The use of adverse publicity (released through the control agencies) associated with non-compliance brought about mixed facility reactions. If the facility was fully aware of its non-compliance and possibly pursuing delay tactics, adverse publicity concerning the continued non-compliance appeared to result in steps by the facility to comply. However, in some instances, public notification appeared to be premature in that the facility owner was not aware of his non-compliance status until he saw it discussed on local television and newscast.

Factors that seem to weigh more heavily against speedy compliance are the duplication of efforts by the city and state control agencies. That is some of the facilities felt they were being nagged, subjected to excessive paper work and caught between the sometimes ill-defined jurisdictional authority between the city and state agencies. In some instances, facilities attempting to comply with state enforcement initiatives by installing control equipment faced local notices of violation aimed at upgrading newly installed equipment and/or controlling additional processes. This situation also appeared to occur in reverse (i.e., IEPA overriding CDEC activities).

3.3 CONTROL EQUIPMENT

The decision made by a facility as to what type of control equipment to install is a result of a complex decision-making process that appears to focus on the following parameters:

- economic considerations
- type of process
- types of pollutants
- combinations of pollutants
- size or throughput of the operation
- age of the facility
- availability of equipment and suppliers
- reliability of the equipment

These factors often make it difficult to compare the sources and their respective control equipment. Table 3-2 groups the 23 sources in the Task II report according to source category with type of control device, capital costs of the device (where available), age of the device, percent time in compliance (since installation), and a comment on the performance of the control device.

There is a wide range of costs of control equipment within the same source category as well as between source categories. This variability within a source category stems from the fact that within a specific source category, pollution control costs will vary as a function of the size and age of the facility (available space considerations); the size or thoughput of the operations (emissions/year to be controlled); the types of pollutants (number and types of control needed); and the availability of reliable proven control technology (procurement, design, installation, start-ups).

The source response (in terms of control equipment) to agency interaction for compliance have centered around the application of "proven technology". That is, a facility would purchase and utilize standardized control devices/methods (i.e., shown to be effective through experience), as opposed to the utilization of innovative control equipment designs (i.e., custom built devices intended to control emission sources for which no proven technology is available). For example, in the steam generating, mineral and food processing categories, properly designed baghouses are utilized with reliable results. On the other hand, as in the lumber and wood products and printing categories, problems in design, installation and reliability were encountered when special built-to-order "filtering systems" were added to control TSP emissions.

Processes involving multiple pollutant control (i.e., steam generators, secondary aluminum smelters) would also generate the largest expenditures in terms of control equipment. This is due in part to the combination of costs associated with control equipment for TSP (baghouses, ESPs) and SO_2 (fuel conversion, scrubbers).

Table 3-2 CONTROL EQUIPMENT - COST AND PERFORMANCE

PROCESS	CONTROL	COST	POLLUTANT	CONTROL EQUIP. AGE	TIME EQUIPMENT IN COMPLIANCE**	STACK TEST	PERFORMANCE OF CONTROL EQUIPMENT
Steam Generator	Fuel Conversion	N/A*	TSP, SO_2	15 yr	99	No	Occasional visible emission problem when equipment failed
Steam Generator	Fuel Conversion Baghouse	N/A $2,500	TSP, SO_2	15 yr	99	No	Occasional visible emission problem Baghouse has controlled this
Steam Generator	Fuel Conversion	$350,000	TSP, SO_2	9 yr	100	No	Regular O & M program
Petroleum Products	Submerge-fill System	N/A	HC	8 yr	100	No	Well within compliance levels
Printing/ Publishing	Afterburner ESPs Solvent Reformulation	$156,000+	TSP, HC	1-10 yr	50 (HC) 0 (TSP)	Yes	Poor performance due to design and operational difficulties
Secondary Aluminum	Baghouse Afterburner	$1,200,000	TSP	1-8 yr	12 (100 after 1977)	Yes	Effective control once baghouse was installed (1977)
Secondary Aluminum	Cyclone Afterburners Baghouse	N/A	TSP	1-15 yr	98	Yes	Afterburner adequate, but baghouse increased control efficiency
Brass/Bronze	Baghouse	N/A	TSP	7 yr	90	No	Maintenance was past problem. Good performance with improved maintenance.
Chemical	Scrubbers Aerators Air Condensers	$1,800,000	HC, odor	18 yr	0	No	Efficiency of system 80%-- Not enough for compliance
Chemical	Baghouse Wet Cyclone	$11,863 29,200	TSP	24 yr	100	No	Efficiency of system increased t adding on cyclone to baghouse sy
Chemical	Incinerator Baghouse	$329,000 8,800	TSP, HC	6 yr	100	Yes	Baghouse 99.9% efficient. Incinerator performance good
Chemical	Scrubbers Condensers Cyclone	$136,500	HC	1-40 yr	88	Yes	Good performance, need for additional equip. dependant on IPCB decision on rule change petition

* N/A = Not Available
** Quantitative estimate derived from facility interview

Table 3-2 CONTROL EQUIPMENT - COST AND PERFORMANCE (continued)

PROCESS	CONTROL	COST	POLLUTANT	AGE	TIME EQUIPMENT IN COMPLIANCE	STACK TEST	PERFORMANCE OF CONTROL EQUIPMENT
Mineral Processes	Baghouse	$373,700	TSP	5 yr	60	No	Equipment performs well if properly maintained. Fugitive dust controlled by discontinui operations during high winds a rain.
Mineral Processes	Baghouse	N/A	TSP	8 yr	100	No	Excellent
Grain Handling	Baghouses	$4-5,000,000	TSP	1-12 yr	100*	No	Fugitive dust problem still exists. Baghouses reduced emissions below compliance lev
Lumber/Wood Products	ESPs Filters Cyclone		TSP,HC	1-5 yr	12	Yes	Poor performance--design and operational problems. "Special systems did not perform well.
Lumber/Wood Products	Exempt Solvents	N/A	HC	2 yr	100	No	Numerous problems during exper mental stage with exempt solve
Food Products	Cyclone, wet-- Baghouses--	N/A $46,000+/ unit	TSP	30 yr	100	No	Baghouses have increased recov ery efficiency of products fro 50-60% to 90%.
Food Products	Fuel Conversion		TSP, SO_2	1-8 yr	100(SO_2) 12(TSP)	No	TSP compliance not achieved un coal use discontinued in 1977.
Surface Coating	Afterburner Exempt Solvents	+$302,000	HC	3 yr	100(1976)	No	Afterburner selected, source f solvent reformulation still in experimental stage (unproven). Performance is good.
Surface Coating	Scrubber Exempt Solvents	$461,000	HC,odors	4-5 yr	100(HC)	Yes	Scrubber did not solve odor problem.

* Fugitive emissions are subject to "nuisance-type" rule and do not reflect compliance of controllable "source"

Table 3-2 CONTROL EQUIPMENT - COST AND PERFORMANCE (continued)

PROCESS	CONTROL	COST	POLLUTANT	AGE	TIME EQUIPMENT IN COMPLIANCE	STACK TEST	PERFORMANCE OF CONTROL EQUIPMENT
Surface Coating	Solvent Reformulation Baghouses Cyclones Scrubbers	N/A	TSP, HC	4 yr (solv)	85-100	Yes	Baghouses and cyclones effecti in TSP control. Acid mists controlled well by scrubbers. Good maintenance program.
Surface Coating	None	N/A	HC	N/A	N/A	No	Control equipment not needed--source not under regulation of control agencies.

Product recovery (as noted in the mineral processing and food processing categories) by use of reliable proven control technology (baghouses) appears to stimulate continual compliance through effective O & M programs.

Control technology for TSP emission reduction appears to be relatively well developed. On the other hand, TSP controls for "fugitive" dust emission source have not been developed to an adequate degree. Facilities which emit fugitive dust have the greatest difficulty in attaining and maintaining compliance (opacity violations). In addition, source categories with SO_2 and HC emissions have reacted to agency interactions for compliance by means such as fuel conversions, solvent switching and reformulation rather than implementing add-on control methods in which there are inherent risks of design, operation and maintenance inadequacies.

Overall it appears that the facilities studies would choose "proven" control technology to achieve compliance even at the expense of higher capital investment. Add-on control technology would result in design and procurement problems, start-up and maintenance problems. These delays leave the facility liable to the city or state agencies for continued compliance.

3.4 EMISSION PROFILES

Sources are regulated according to the amount of pollutants they emit over time. The compliance level is determined by the control agencies which furthers the goal of attaining and maintaining the ambient air quality standards. The exceedance of a control regulation by a source category may be the result of several factors.

Most TSP exceedances resulted in visible emissions which would prompt the filing of citizen complaints with either the city or state agencies. In addition, these visible emissions may be noticed by one of the CDEC roving inspectors and result in an immediate notice of violation (i.e., ticket). Usually visible emission exceedances were of short duration (less than 15 minutes) resulting from soot blowing, startup, and malfunctions. In the latter case, immediate corrective action or shutdown minimized the duration of the exceedance.

Several causes for continued exceedances of emission limitations were identified in the course of the study. A number of facility owner/operators indicated that costs associated with the implementation of a control alternative far outweighed the costs realized while remaining in the non-compliance situation (i.e., the benefits of non-compliance). This appears to have influenced decisions favoring non-compliance in the printing and food processing source categories. Also, a source may be in compliance with regards to the emissions regulations but, at the same time be guilty of administrative non-compliance for operating without a permit (as in the cases involving the food processing, surface coating categories). Periods of non-compliance may also be the result of an ensuing enforcement/legal proceeding. The secondary aluminum and chemical processing source categories remained in non-compliance while awaiting a decision from the IPCB. This type of exceedance may be of long duration due to long court delays. Utilizing control technology that is not well developed for a particular process (as in the instance of the printing/publishing and lumber/wood source categories) can also result in long delays for compliance. Poor design and start-up performance as well as operational malfunctions, can result in non-compliance. Control technology for fugitive emissions is not well developed, and a source with this type of emission tended to experience difficulty in maintaining compliance (e.g. mineral processing source category).

As in the case of the grain handling and lumber/wood processing source categories, procurement and installations of control equipment was an extremely time consuming process. In addition, start-up performance of the new equipment was generally poor -- subsequently, exceedances were of a long durations. It was also noted that poor housekeeping also appeared to result in malfunctions, as in the case of the brass/bronze category. However, these exceedances were of relatively short duration. An established O & M program could serve to minimize such occurances.

3.5 SOURCE DECISION-MAKING

The decision process by corporate management to comply (or not to comply) with a given set of control regulations is the result of a complex set of interactions within the corporate structure. In the case of the smaller facilities, the ultimate decisions are made by the onwer/operator (president, plant manager or superintendent). Larger facilities delegated the environmental decision making to an "environmental staff" for recommendations, with the final decisions coming from the corporate headquarters.

Considerations such as fuel availability and rising fuel costs, citizen complaints, reliable cost effective compliance controls, adverse publicity, coupled with the decision that voluntary compliance may give the facility more flexibility in an ultimate compliance approach schedule (mineral processing, grain handling) are motivating factors resulting in prompt decisions regarding initial and continued compliance. However, The threat of agency litigation/enforcement actions and pressure exerted by the city or state agency from continued periodic inspections did not appear to be highly motivating in terms of ultimate compliance decisions by the source.

As discussed in the Task II report, economic considerations in the control-decision making process are not merely the "cost of compliance", but instead, represent the outcome of a complex decision process. The decision process, itself, must focus on tangible (facility size, age, pollutants, control equipment), intangible (pure costs, product impact), internal (financial strength), and external economic considerations. Each of these parameters receive varying priorities within each facility.

In one source category (food processing), the decision for installation of control devices (baghouses) was based on economic considerations regarding byproducts (i.e. starch recovery) and equipment safety factors. Thus, the associated cleanup of air pollutants was in essence a beneficial side effect. This source did not voluntarily seek state permits for these operations but simply responded to IEPA pressure to do so. As a result of the installation and operation of the baghouse, the facility realized a starch recovery rate in excess of 99 percent (where the previous recovery rate was approximately 50-60 percent utilizing cyclones). As assessment of the value of this increase in product reclamation was not available from the facility management.

Mineral processing and grain handling source categories also realize profitable product recovery when utilizing efficient control devices. Although specific recovery rates and product replacement costs were not available from the facilities inspected, the economic benefits realized were definitely the chief motivator for implementation of very efficient control equipment.

3.6 COMPARISON OF SOURCES WITHIN CATEGORIES

Within source categories, the facilities would favor the purchase and utilization of more "proven technology" for that category, as opposed to the purchase and utilizaton of innovative or technology forcing control equipment for unusual process equipment. For example compliance problems were less apparent when properly designed TSP baghouses and/or electrostatic precipitators were utilized in the steam generating, mineral processs, and food processes. However, procurement, installation, and operational problems were encountered within the chemical, secondary aluminum and printing source categories.

When multiple pollutant control requirements are involved (i.e. TSP and SO_2 emissions in steam generating units), or the control of SO_2 froom large boilers or HC control from surface coating operations, most control efforts centered around fuel conversions and/or solvent switching to meet compliance requirements.

Within the same source category, there appeared to be a wide range of costs related to pollution control. The pollution control costs varied as a function of facility size and age (available space considerations, throughput); process (equipment design, throughput rates, material recoverability potential); pollutants; and available control techniques (reliability, design, construction, O & M). It was not certain that costs may related within source categories as a function of whether or not similar control equipment and/or pollutants are involved (e.g. secondary aluminum, chemical processing, lumber/wood products, surface coating).

The O & M costs within the source categories encountered did not indicate such a wide range of costs as equipment costs. The O & M costs again appeared to be dependent on facility size (available space); process (throughout rates, material recoverability potential, equipment design); control equipment reliability; as well as the O & M emphasis by the facility management. This latter point appeared to be a function of the pollutants involved coupled with the potential for recoverable products thereby resulting in adequate preparation and implementation funding of control equipment O & M programs. The surface coating category indicated the highest O & M costs of the categories encountered, which were based upon large scale solvent switching and associated equipment maintenance and operation costs (i.e., fuel requirements in case of incineration).

3.6.1 SECONDARY ALUMINUM

The two secondary aluminum operations both housed a variety of different operations, and, therefore a number of different pollution sources. Major sources were the aluminum reverberating furnaces which emit metallic oxides in the form of particulate dust (large size range) as well as smoke and fumes from charging and fluxing operations. The discharge contains both particulates and gaseous pollutants. Control equipment selection was thereby made difficult. The first source experienced problems with the control alternatives chosen due to economic considerations.

Although the afterburner/fume scrubber system effectively reduced both particulate and gaseous emissions, the operating costs associated with the system were found to be prohibitively high (i.e., fuel for afterburner; and the water treatment problem associated with scrubber effluent). A less costly alternative control method was therefore sought, identified, and implemented. A baghouse has now replaced the scrubber component. The facility representatives noted that no specific assistance was provided by either the state or city regulatory agencies in selecting or approving the control system design prior to installation.

The second facility described in the study was operating the furnaces without control for eight years (up until June 1977). Violation of permit emission standards were not detected until December 1972, two years after its start-up. Once served with notice of violation (Nov.), the source responded that such notification was unjustified and pleaded ignorance of any permitting requirements, deficiencies, or emission limitation violations. As a result, enforcement actions were ultimately initiated by the IEPA through litigation. The facility owner denounced this approach as unreasonable to bring a source into compliance, praising the approach of arbitration utilized by the CDEC. The facility management stated that technical assistance provided by CDEC personnel was instrumental in choosing and installing an excellant control system. The facility representative explained that IEPA enforcement actions through litigation were time consuming, and did no more than allow time needed for selection and verification of an adequate control method.

3.6.2 STEAM GENERATING

All of these steam generating plants encountered in the study chose fuel conversion (to less than one percent sulfur content), to achieve and maintain compliance with applicable emission standards.

In addition, one plant installed a baghouse in response to numerous citizen complaints of excessive visible emissions arising from soot blowing operations. This installation was the source's desire to be a good-neighbor since the soot-blow operation and associated visible emission exceedances were within permitted limits. All of the plants have been in compliance with the exception of minor violations during equipment malfunction, and one unit which appeared to be out of compliance on the basis of a source test.

3.6.3 CHEMICAL SOURCES

The four chemical sources studied exhibited considerable variation in regards to pollution control equipment. Indeed, this is due to the large variety of chemical processes that represent potential air pollution sources. At the time of the PES inspections two of the sources were operating in violation of the regulations. However, this was not due to equipment failure but instead to the outcome of an IPCB ruling on a petition for a rule change. One source maintained compliance by shutting down operations during equipment malfunctions.

3.6.4 MINERAL PROCESSES

The two mineral process sources encountered were similar in that they had chosen baghouses to control their particulate emissions. Fugitive dust emissions continue to be a problem with one source, but this problem has been partially abated by an agreement not to operate during periods of excess wind and rains.

3.6.5 FOOD PRODUCT SOURCES

The food product sources examined in the study differed in control equipment and associated costs. One source decided to use a baghouse since the device had a high potential for product recovery (starch, in this instance). The other facility had no recoverability but still had to control emissions from boilers. This was accomplished through a fuel conversion.

3.6.6 LUMBER AND WOOD PRODUCTS

The lumber and wood products source category is a good example of two similar sources achieving quite different levels of compliance. One source chose the use of exempt solvents rather than install control devices on their coating equipment. This approach proved successful and the facility is well within compliance. The other source encountered had continual problems with the control devices installed to control emissions from a woodwaste boiler. Design and operatonal inadequacies have resulted in almost continual non-compliance. Initially this source chose the least expensive equipment (i.e., an ESP) to control emissions. All the systems installed were essentially unproven control for this type of emission source.

3.6.7 SURFACE COATING

The surface coating source category is unique in that one source coose to hold back production rather than deal with the control agencies, and possibly incur the costs of control devices to reduce hydrocarbons emissions. The three other sources reviewed have successfully controlled hydrocarbon emissions by switching to the use of exempt solvents.

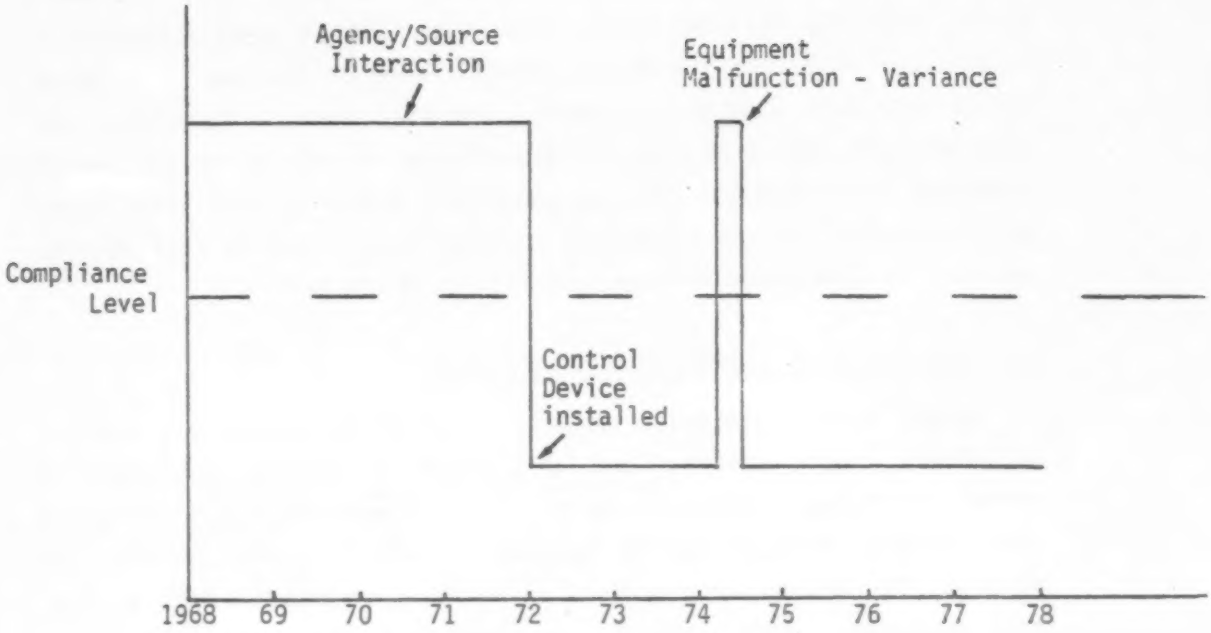
3.6.8 GENERAL CATEGORIES

The petroleum, printing/publishing, brass/bronze and grain handling source categories are each represented by only one source. Therefore, the factors associated with the control of their specific pollutants cannot be taken as representative of that particular source category. Particulate emission sources were controlled successfully by use of baghouses. The printing/publishing source was the only one that had a chronic non-compliance problem. They experienced many problems with an ESP (the least expensive control device in this case) and in general, this source made a poor response effort intended to attain compliance. The bulk terminal did not utilize any of the advanced control tecnniques generally employed by facilities located in the west coast hydrocarbon/photochemical oxidants non-attainment areas. Facility representatives noted that CDEC personnel had made a recommendation to install and/or retrofit some of the source emission points with such control equipment. The only control mechanisms associated with petroleum transfer and storage operations is the use of submerged fill for truck loading operations involving distillate oils, and bottom fill of the fixed-roof storage tanks. Bottom fill is also employed in stationary storage tank filling operations.

3.7 COMPARISON OF SOURCES ACROSS CATEGORIES

Across source categories, sources involved in controlling similar pollutants, favor purchase and utilization of control equipment of proven technology. Emission exceedances are most certainly minimized when properly designed control devices are selected. For example, TSP controls for sources with product recoverability potential (e.g. mineral processes, grain handling, and load processes), are well developed in the form of baghouses. Effective control systems for the removel of TSP generated by fuel combustion sources are also relatively well defined through the use of electrostatic precipatators and/or baghouses.

Fuel combustion sources are also the major source category responsible for SO_2 generation. Emission of this pollutant was regulated through the establishment of a maximum sulfur content rule. Facilities were, therefore, about to come into compliance by converting their fuel burning equipment to enable firing of low sulfur content fuels. Industries that operated fuel combustion sources chose almost universally to undergo existing equipment conversion rather than remain utilizing nonexempt fuel, and be forced to install add-on control technologies (i.e., scrubber, ESP's). Costs of conversion were relatively low as compared to the cost of an add-on control technology alternative, as demonstrated in the case of a chemical manufacturing steam plant visited by PES.



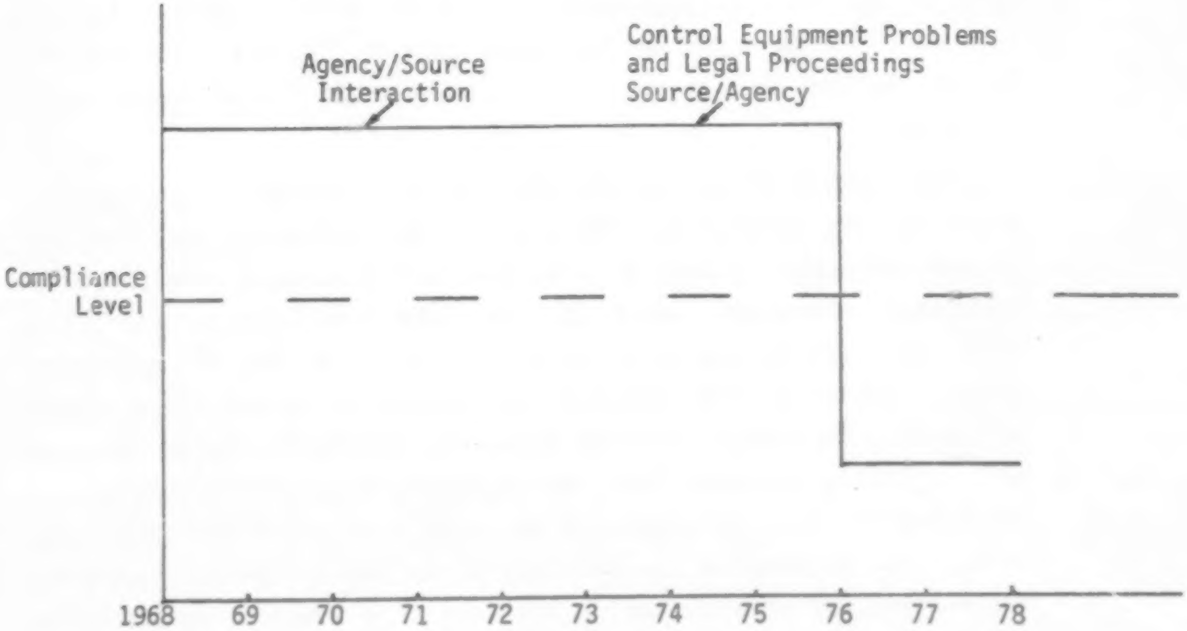


Figure 3-1. TYPICAL TSP EMISSION PROFILE

In some instances involving visible emission control problems (e.g. printing/publishing and lumber/wood products source categories), control techniques such as filtering systems (whose performance was uncertain for these operations) led to many operational problems which resulted in overall compliance delays.

Across the board hydrocarbon emissions control was found to present a much more involved compliance problem. More factors enter into the picture due to the numerous control methods which must be evaluated for a particular application. Decisions regarding economic recoverability (i.e., solvent recovery), operating costs (i.e., fuel usage for afterburners), and longevity of solution, as in the case of reformulation (i.e. high solids coatings) or switching to exempt solvents, must be based upon well researched and documented information. In hydrocarbon control, future trends in fuel availability and increasingly stringent standards must be considered closely. For these reasons, similar emitting sources were not observed to be fitted with similar controls in many instances.

The costs of similar control equipment across source categories (including O & M costs) vary as a function of the facility size, age, type of process, throughput rates, material recoverability potential, and availability of reliable control techniques for each process.

Generally, it appeared that sources which worked within tight environmental program budgets were prone to selecting the least costly control alternative or taking a gamble with a less costly or unproven control technology. Many times these sources suffered as the equipment either failed due to unforseen design factors (e.g., nature of emissions - caustic or acidic), failed to meet manufacturer's quoted control capabilities, or presented unabsorbable operating/maintenance costs.

3.8 CONCLUSIONS

It is apparent from the study that source response to emission compliance is a function of both technical and non-technical considerations. Technical considerations are a function of activities specific for a source category and center around the application of best or "proven" technology. Control technology appears to be more developed for TSP control (with the exception of fugitive TSP emissions) than for SO_2 or HC control. Timelines of equipment procurement, and proper design, construction/installation and start-up performance are other technical factors affecting source compliance.

Non-technical considerations for initial compliance attainment are more of a function of the regulatory agency actions than activities specific to a particular source category. Actions aimed at initial compliance are most effective utilizing a strong permit system coupled with a high degree of control agency/facility interaction. In regards to this interaction, arbitration (rather than enforcement/legal proceedings) monitoring progress toward complaince with constant control agency/facility interaction appears to be more effective in bringing about ultimate compliance. Economic motivation such as convincing the owner/operator of the facility that it is more cost-effective to attain compliance than to delay compliance, also appears to be a more effective agency action in bringing about compliance in lieu of enforcement/legal proceedings against the source. Other effective agency actions (although to a lesser degree) in bringing about compliance appear to include enforcement/legal proceedings, adverse publicity associated with non-compliance and continued agency pressure through periodic inspections and the issuance of violation notices.

Source response time to compliance varied as a function of regulatory agency actions, available control technology and the economic stability of the source. A few sources were always in compliance (such as steam generators, chemical and petroleum products source categories), where control efforts centered around fuel conversions and/or solvent switching/reformulation. Product recovery was a highly motivating factor for initial and continual TSP control (for the mineral processes and food products categories). Facilities experiencing technological design and operational problems for their particular process (printing/publishing, lumber/wood products source categories) could not achieve a timely and effective compliance program. Continual non-compliance of a source (such as in the case of the secondary aluminum and chemicals source categories) was evident of facilities engaged in ongoing litigation with the enforcement branch of the IEPA and/or CUEC. Rulings in favor of the control agencies prompted the facility to enter into agreements to control emissions.

Costs of control vary widely within source categories as well as across source categories. Again, the costs appeared to vary as a function of facility size, age, operational throughput, number of pollutants associated with the emission source, and availability of proven control technology.

Multi-pollutant emitting sources are unvariably confronted with a more costly and complex control problem. Multi-component control systems are generally required, with each individual component selectively treating a particular pollutant type as the exhaust gas stream passed through the unit. This appeared to be the case in both of the secondary aluminum operations; with one facility utilizing an afterburner/baghouse system and the other facility using a more advanced sophisticated baghouse system. This latter system has associated with it a precool quench section, an evaporator vessel, and finally the baghouse compartments (where the bags are coated with a compound which selectively absorbs gaseous emissions).

Of the three pollutants studies (TSP, SO_2 and HC) control techniques are more developed for TSP control than for SO_2 or HC. In addition, for the facilities reviewed in this study, SO_2 compliance was attained and maintained by fuel conversions and HC compliance was controlled by use of solvent switching, reformulation, or incineration. Fugitive TSP emissions are difficult to control and extent of control was limited (as in the case involving mineral processing). Processes using innovative control technology experienced many problems in maintaining compliance.

Smaller facilities generally fit into the category of industries with relatively tight environmental budgets. Large facilities with more extensive corporate decision making bodies are much better equipped to make accurate assessments of control requirements, and to absorb the costs of implementation. For example, the mineral transfer depot encountered in the study is a wholly owned entity of a very large mother company which maintains its own staff of environmental engineers. In this instance, viable solutions were sought by their own corporate staff through extensive research. Other emission sources within the corporate structure were contacted as well as sources within the industry to determine if a similar problem had been encountered and successfully treated. Enonomic and technical feasibility of similar processes (i.e., handling crushed material) were evaluated also. Innovative control systems were observed which even had integral interlock systems to assure proper operation.

Another observation can be made from the previous example which appears to apply to other facilities visited. Generally, the smaller facility tended to pursue a quick and inexpensive solution to achieve compliance rather than utilize stall tactics (ie., play along with the enforcement approach) in order to buy time necessary to search out a viable and proven technology. At the same time, the larger facilities were more likely to use the legal system in this fashion, thereby prolonging the final compliance date. The outcome of this tactic was, however, found to be more promising with respect to a "continued" compliance point of view.

Better equipment with improved performance and longer effective life were generally observed at the faclities which used this approach while smaller facilities were plagued with problems such as ineffective control and rapid deterioration of equipment. A comparison of the mineral distribution facility and the wood and lumber products (involving wood cabinets) plant served to illustrate this point quite well.

4.0 CASUAL RELATIONSHIPS: AGENCY AND SOURCES

4.1 INTRODUCTION

Analysis of the CDEC/IEPA regulatory programs, practices and policies resulting from this study have indicated relationships (positive and negative) between agency actions and source response and/or performance in respect to applicable control regulations.

An effective tool for bringing a facility into the regulatory system is the permit system. The importance of the permit system is that of initial contact between this facility and the control agency. Compliance from that point on is dependent on the effectiveness of the subsequent facility-control agency interactions. These interactions may vary as a function of control agency involved; type of facility involved (i.e. process and/or pollutants); the size of the facility (i.e. overall throughput); the economic stability of the facility; and the availability of proven control technology (i.e. add-on equipment vs. "packaged" controls). The source response to the control agency requests for administrative compliance by obtaining the proper permits appears to be well accepted by most facilities in this study. However, some sources had no intention of applying for permits until forced to do so by the control agencies. Reasons stated for these type of actions included excessive paperwork coupled with a duplication of efforts regarding permits and inspections by the local and state agencies. In addition, although not specifically stated by the source studies, application for permit may draw the control agency attention to a process in need of control equipment that the facility may feel is too costly to install and operate. Permit denials were effective when coupled with agency guidance and monitoring of a compliance program (as noted in the categories involving surface coating, brass and bronze sources).

Arbitration is a control strategy utilized by the control agencies with a non-complying source. The arbitration process results in a compliance schedule and/or progress reports toward complaince which are monitored closely by the control agency to assure that substantial milestones were achieved. This strategy is used to varying degrees of success by the CDEC and IEPA depending on source size and the respective magnitude of the air pollution problem associated with a particular source.

The compliance strategy of enforcement/litigation may have different degrees of effectiveness. The cost effectiveness of compliance (or non-compliance) weighs heavily in the facility's decision to comply or face the enforcement/litigation action of a control agency. In other words, the facility owner/operator must weigh the decision to whether or not tactics/costs associated with delaying compliance may exceed the utlimate cost of compliance.

Continued periodic inspections serve as a somewhat regular reminder to the facility owner/operator of the facility's overall compliance status. The effectiveness of this strategy may be enhanced when coupled with a high facility commitment toward achieving or maintaining compliance. Continuous inspections, with lack of agency direction or involvement, may work against compliance by the source. It was found that through the facility interviews control agency technical assistance is generally well received, and represents a very positive factor in achieving initial source compliance.

In general, the CDEC tends to use "non-technical" personnel (those without the engineering expertise) to inspect for source compliance. Even though this type of personnel is utilized, the fact that there are so many inspectors "on the road" insures a quick response to citizen nuisance complaints, opacity violations , and their mere presence and authority to issue violation tickets acts as a stimulus to comply with ordinances. The CDEC appears to concern itself mainly with the particulate and opacity aspects of air pollution, which is related to the qualifications of the roving inspectors and citizen complaints. However, the control of SO_2 is maintained through the CDEC's restriction on low sulfur fuel. Regarding hydrocarbons, as in the case of the bicycle manufacturer visited by PES staff, the CDEC appears to play a passive role, as backup to the IEPA which maintains the more active role for this pollutant.

The IEPA tends to use a higher caliber technical personnel for a source's compliance inspection. However, in terms of number of personnel available, the IEPA is very limited. Therefore, they tend to concentrate their efforts on sources with major pollutant emission problems or sources that have the potential for such problems (sources larger than 100 TPY emissions). The IEPA tends to favor the enforcement/litigation mode of action (where CDEC favors arbitration) on a non-complying source. In one instance, the IEPA filed an enforcement action with the IPCB which resulted in a decision in favor of the IEPA. The CDEC also interacted with this source resulting in at least 14 hearings following the progress of the source in meeting compliance. The action taken by the IEPA in conjunction with the CDEC did result in a facility agreement to control emissions.

One apparent weakness of the CDEC system stems from the fact that personnel lacking engineering expertise are sent out to a facility in an enforcement role. Their efforts are directed mainly toward particulte and visible emission control. However, a large number of this type of personnel are available to the city with a substantial savings to the city in terms of salary requirements. The IEPA employs fewer personnel, but with the greater engineering expertise. Therefore, there is a larger response to inspection of a source suspected of non-compliance, but the inspection is of a more sophisticated nature.

4.2 PERMITTING

The CDEC's system is a two stage system, providing for pre-construction review in the form of an installation permit, and an annual Certificate of Operation (COO). The permit system administered by the CDEC is consistent with the requirements of the Federal Clean Air Act, the laws of the State of Illinois, and Chapter 17 of the Municipal Code of Chicago, Environmental Control Ordinance. The agency operates under the air pollution control rules contained in Article II of the Code. As indicated earlier, the City regulations were incorporated into the State Implementation Plan (SIP).

The IEPA's system is a two stage system, providing for pre-construction review, in the form of a construction permit, and a five year renewable operating permit. The permit system administered by the IEPA is also consistent with the requirements of the Federal Clean Air Act and the State of Illinois Air Pollution Control Regulations, which were included within the SIP in 1971.

Arguments both for and against permit systems have been advanced. Those in favor of the permit system include: (1) Pre-construction review is very effective in preventing installation of equipment which cannot possibly meet emission standards; (2) the permitting process is a major source of information on air pollution sources and for emission inventories; (3) pre-construction review minimizes the charge of lengthy enforcement actions against sources which violate emission standards after installing control equipment; (4) the permitting system at the local CDEC level facilitates the pre-construction review required by Federally mandated Prevention of Significant Deterioration (PSD) and New Source Review programs, (5) the permit system tends to equalize the efforts and burdens of control by different sources, and (6) when an annual permit system is added to the permitting process, it stimulates the proper maintenance of air pollution control equipment and thus tends to keep subsequent emission levels down .

Arguments against permit systems include: (1) the effectiveness of the system depends in large part on the assumption that the agency's pre-construction engineering review will produce valid and accurate findings which has not been demonstrated to be a consistent finding; (2) the system stifles industry initiative to develop more innovative and cost effective control methods; (3) the permitting process can be used to force unnecessary expenditures; (4) the permit systems cost too much to administer; (5) the information gathering aspect of the process may be misused to obtain unnecessary data and may actually invade privacy; and (6) there are inadequate standards of review applied across agencies.

The CDEC and IEPA permit systems have provided substantial data on sources and their emissions and standardization of controls such as use of low sulfur fuel and exhaust solvents in the steam generating and surface coating categories. However, not all control equipment permitted by the agencies functioned properly and necessary corrective actions had to be taken, in many instances without guidance from the control agencies.

4.3 CONTROL EQUIPMENT

The initial selection of control equipment is, in part, based on the control agency permit application process. The agency reviews each application for technical feasibility, and a decision is made for the approval/disapproval of the permit based on: 1) the design removal efficiency of the control equipment, and the actual control needed for compliance with the applicable regulation(s); and 2) the determinations whether the ambient air quality standard will be met. Ideally, if the agency determines that the chosen equipment may be inadequate, technical quidance is offered to achieve initial compliance.

The choice of control equipment may be influenced by many factors such as facility size and age (e.g. space limitations process design, etc.). However, two factors that weigh heavily in a source's decision are the cost of the equipment (capital cost as well as operation and maintenance), and the performance potential with respect to the ability of the equipment to control emissions now and in the future. The agencies' concern of control equipment selection rests with the amount of emission reduction needed to attain and maintain air quality standards. Considering these factors, a close interaction between the source and the CDEC and/or IEPA developed in some instances resulting in a program toward compliance. Table 4-1 reviews the 23 sources - the Task II report, their control equipment, the primary reason for choosing the control, source/agency interactions, and a general comment. The souces are grouped according to process categories.

The source response to agency pressure to control particulate emissions has favored the installation of baghouses. This is especially true in cases where potential for product receivability exists (i.e., mineral processes and food products). The bag house appears to be a "proven" technological control device for particulate emissions. Control of "fugitive" TSP is more difficult, and controls require special control techniques that may or may not solve the problem.

Scrubbers, cyclones and ESP's, are also used to control particulates. However, the efficiency of these control devices is less than that of the baghouse system. In some instances, scrubbers were unable to control odor problems (i.e., surface coating). Design and operational difficulties were encountered using the above methods of control.

Hydrocarbon emissions were best controlled by use of non-photochemically reactive solvents (i.e., surface coating, lumber/wood products categories). Incineration has proved to be too expensive

Table 4-1 CONTROL EQUIPMENT-SELECTION BY SOURCE

Process	Control Device	Pollutant	Age	Time Equipment in Compliance (%)	Reason for Choosing Control	Source/CDEC Interaction	Source/IEPA Interaction	General Comments
Steam generator c.c.	Fuel conversion	TSP, SO_2	15 yr	99	High fuel costs	None	Good	State owned plant-minor violations have occurred due to malfunctions-quickly corrected
Steam generator c.c.	Fuel conversion baghouse	TSP, SO_2	15 yr	99 Due to 1% S Fuel	High fuel costs, Baghouse effectively controls soot blowing	Good	Good	Voluntarily installed controls to appease local citizens-Visible emission exceedances were within permitted limits
Steam generator c.c.	Full conversion	TSP, SO_2	9 yr	100	Negotiations with CDEC	Good	Fair	Regular O & M program
Petroleum	Submerge-fill	HC	8 yr	100	Non-environmentally related factors	Fair	Good	Agency interaction related to administrative functions
Printing/publishing c.c.	Afterburner ESP's reformulation	TSP, HS	1-10yr	50 (HC) 0 (TSP)	Choose less expensive equipment (ESP) to control TSP	Good	Fair	Source operating in violation. Effective compliance program could not be achieved-poor response by source for compliance
Secondary aluminum c.c.	Baghouse afterburner	TSP	1-8 yr	12 (100 after 1977)	Legal battle. Agency pressure	Good	Poor	Source/IEPA in litigatio for entirety of study periods-Controls upgraded in 1977
Secondary aluminum	Cyclone afterburners baghouse	TSP	1-15 yr	98	Fuel costs, negotiations with CDEC	Good	Good	Source is in compliance

Table 4-1 CONTROL EQUIPMENT-SELECTION BY SOURCE (cont.)

Process	Control Device	Pollutant	Age	Time Equipment in Compliance (%)	Reason for Choosing Control	Source/CDEC Interaction	Source/IEPA Interaction	General Comments
Brass/ bronze	Baghouse	TSP	7 yr	90	Negotiations with CDEC	Good	Good	Housekeeping problem/ maintenance improved through IEPA information
Chemical c.c.-odor	Scrubbers aerators air condensers	Organics	18 yr	0	IEPA/CDEC negotiations	Good	Good	Compliance status of source dependent on IPCB decision
Chemical	Baghouse wet cyclone	TSP	24 yr	100	Source's own initiative	Good	Good	Good maintenance
Chemical	Incinerator baghouse	HC, HCN, TSP		100	Effective control of both HC and HCN (incinerator) IEPA negotiations	Good	Good	Shut down during malfunctions insuring continuous compliance
Chemical	Scrubber condenser cyclone	HC	1-40 yr	88	Negotiations with CDEC (1970)	Good	Good	Compliance status of source dependent on IPCB decision. Good O & M
Mineral processes c.c.	Baghouse	TSP	5 yr	60	Product recoverability (economic) and negotiations with CDEC/IEPA	Good	Good	Fugitive dust and equipment malfunctions have been past problems. Compliance improved with time as baghouses were installed on individual units.
Mineral processes	Baghouse	TSP	+8 yr	100	Source's own initiative prior 1970	Good	Good	Source is in compliance Good maintenance

Table 4-1 CONTROL EQUIPMENT-SELECTION BY SOURCE (cont.)

Process	Control Device	Pollutant	Age	Time Equipment in Compliance (%)	Reason for Choosing Control	Source/CDEC Interaction	Source/IEPA Interaction	General Comments
Grain handling	Baghouse	TSP	1-12 yr	100	Negotiations with CDEC	Good	Fair	Good maintenance .
Lumber/ wood products c.c.	ESP (discontinued in 1973 gas scrubber	TSP, HC		12	Initially choose least expensive equipment (ESP) in response to negotiations with CDEC/IEPA	Good	Poor	Design and operational inadequacies have resulted in almost continual non-compliance
Lumber/ wood products	Exempt solvents	HC	2 yr	100	Response to a consent agreement with U.S. EPA Enforcement Division	Fair	Fair	Source choose a switch for exempt solvents rather than install control equipment. Source dissatisfied with U.S. EPA/IEPA compliance
Foods products	Wet collectors baghouses	TSP	28 yr	100	Product reconvertability, economic factors	Good	Fair	Good maintenance. Source did only minimum for IEPA administrative compliance
Food products	Fuel conversion	TSP, SO_2	1-8 yr	100 (SO_2) 12 (TSP)	Negotiation with CDEC and economic factors	Good	Fair	Source delayed TSP compliance until coal supply was exhausted
Surface coatings	Afterburner exempt solvents	HC	3 yr	100 (1976)	Negotiations with IEPA, CDEC. Non-compliance until afterburner installed	Good	Good	Source felt State Regulations in error. Experimenting with exempt solvents.

Table 4-1 CONTROL EQUIPMENT-SELECTION BY SOURCE (cont.)

Process	Control Device	Pollutant	Age	Time Equipment in Compliance (%)	Reason for Choosing Control	Source/CDEC Interaction	Source/IEPA Interaction	General Comments
Surface coating	Scrubber exempt solvents	HC	4-5 yr	100 (solvents)	Response to control agencies' permitting process	Good	Good	Odor problem still exists
Surface coating	Exempt solvents, cyclones, baghouses scrubbers	HC TSP	4 yr (solvents)	85 (since 1974)	Response to IEPA permitting process	Good	Good	Source excellent rapport with control agencies
Surface coating	N/A	HC	N/A	N/A	Precontrolled VOC emissions do not exceed allowable limit	Good	Poor	Source has chosen to limit consumption to avoid being eligible for IEPA regulations

due to fuel costs, and the sources appear to favor the "sure" method of control in response to agency pressure to control HC emissions.

The sources reviewed also tended to favor the use of low sulfur fuel for control of sulfur dioxide (SO_2) emissions (i.e., steam generators, food products categories). City regulation of fuel oil with a less than one percent sulfur content insures compliance in this area.

One source (surface coating) elected to avoid control agency regulation and possible use of control devices by limiting its consumption of raw materials. That is, the facility lowered its allowable process throughput rate.

4.4 COMPLIANCE SCHEDULES

A compliance schedule is an orderly program for reducing emissions from a source. The milestones commonly included in a compliance schedule are: (1) the date of submittal of final control plan to the regulatory agency, (2) the date of award of control device contract, (3) the date of the initiation of on-site construction or installation of emission control equipment, (4) the date by which on-site construction or installation of emission control equipment is completed, and (5) the date by which final compliance is acheived. Most often, compliance schedules are mutual agreements between the source and the regulatory agency. If, however, the compliance schedule is ordered by a court, the court may set a daily fine or other penalty for missing one of the milestones.

The process of setting a compliance schedule generally occurs after a source has applied for an operating permit, after a violation notice has been served, and/or after a hearing or court decision. The time scales for compliance shcedules will vary according to the process and other factors such as space limitations at the site, inclement weather, delay in equipment deliveries, or design problems due to lack of engineering data.

Secondary aluminum smelting source No. 1 is an example of a source that resisted control agency pressure to control emissions and was engaged in extensive IEPA/IPCB litigation. As a result of negotiations for a voluntary compliance program, the source agreed to install a baghouse control device and filed a petition for variance with the IEPA to operate while under the compliance schedule. The source also requested a period of grace from the City for the same time period. The CDEC was aware of the problem in March 1972 and the IEPA began enforcement action in January 1972. Finally, after a long delay, the control equipment was installed and operable in 1977. The compliance schedule was a result of extensive IEPA/CDEC interaction.

Mineral processing source No. 1 was issued a Notice of Violation in March 1972 and was requested by the IEPA to formulate a formal compliance schedule. At the same time, the CDEC requested a schedule toward compliance. Fugitive emissons and equipment malfunctions delayed compliance until 1975. In addition, a settlement reached with the CDEC requires curtailment of unloading operations during periods of rain or excess winds.

The grain handling source is a good example of a source that began a compliance program in response to CDEC negotiations. The compliance program was to cover a period of 1962 - 1976, and was closely monitored as evidenced by over 100 separate pieces of correspondence in the CDEC files. The IEPA also monitored the compliance program with engineering reports and/or opacity readings. Since this source developed a schedule prior to the Clean Air Act of 1970, they did not alter the schudule to meet the original 1975 attainment date.

The printing/publishing source is an example of a situation where a timely and effective compliance program could not be achieved. Insufficient enforcement and lack of agency guidance were factors leading to an ineffective control program. Utilization of control techniques whose performance was uncertain for printing operations and design inadequacies led to many problems delaying compliance. The compliance program (as part of the IEPA operating permit) was begun in April 1973. To date, the source has not achieved compliance.

Compliance schedules have been used by both the CDEC and IEPA to monitor timely installation of control devices. For various reasons (design inadequacies, operational difficulties, procurement delays), these schedules have experienced timely delays. One source, food processing, delayed compliance until its coal supply finally ran out in 1977. Overall, the compliance schedules are effective in monitoring a sources' efforts toward achieving compliance.

4.5 INSPECTIONS

The CDEC's Inspection and Enforcement Division are responsible for surveillance investigations (25 mobile inspectors), complaint investigations, ticket issuing, annual inspections, enforcement investigations, source testing and permit assistance. Certificates of Operation are issued as a result of satisfactory annual inspections. Certificates are valid during the calendar year the source is inspected or until the next year's annual inspection. Usually all sources within a square mile are inspected during the same month of each year. Each inspection is conducted on an unannounced basis. However, visible emission observations and/or facility inspections are conducted in response to citizen complaints or whenever an inspector feels one necessary (violation usually noted by roving inspector).

The Department performs a routine annual inspection to verify operating procedures, note modifications (i.e., process source additions/deletions), and request additional data where required. Inspections were described to be quite extensive by source representatives. Field men observe all emission points (i.e., roof top checks) to verify correspondence between data field in the previous year's report. This one to one correspondence by roster check helps identify any new sources. Any new sources discovered during the survey are then noted and brought into the permit system if appropriate. Facility contacts mentioned that the annual visits were easily anticipated since they performed at or around the same time each year.

For example, a secondary aluminum facility (see Task II report) was brought into the system by one such inspection. CDEC inspectors detected violations of permit and weight emissions requirements and consequently denied the source its certificate to operate. Under terms of compliance plan arrivedat subsequent to much negotiation and legal interaction,progress towards incremental compliance was also monitored and verified by periodic physical inspection as well as by plant reporting.

CDEC roving inspectors conduct daily "spot checks" in heavily industrialized areas. This system provides a method of continuous overall surveillance of a great number of facilities which are known to have potential control problems, and detection of obvious visible emission problems in heavily industrialized areas is thereby made possible. This type of inspection is effective in that the facility is constantly aware that it is under surveillance by the CDEC, thereby providing strong incentive for continued compliance which, in turn, necessitates an effective maintenance program.

An example of the positive nature of this constant surveillance was noted by the lime transfer depot manager (see Task II report, Mineral Products). He explained that, although relations with the CDEC roving inspectors were excellent, he had no doubt that a ticket would be issued should a violation be spotted. In fact, a ticket was issued for a violation which he had reported to the CDEC as a malfunction (per the malfunction reporting requirements).

The city agency also performs periodic (i.e. weekly, monthly) inspections. This type of unannounced surveillance activity is used as a check on sources which are currently being prosecuted or for which future enforcement cases are deing developed against the source. It is also used to verify increments of progress being met by sources operating under conditions of a compliance program.

The effectiveness of this type of inspection is positive in that it can yield data that can be used to build a sound enforcement case against a non-complying source which should ultimately produce a court order and the attainment of compliance. It also makes the source aware that the CDEC is conscious of their efforts in following progress of a control plant. Evidence of this type of monitoring/surveillance activity was noted for chemical manufacturing, grain handling, printing, and mineral handling facilities.

The IEPA performs annual inspections to verify compliance with state air pollution control regulations. Facility personnel felt IEPA inspections were also quite thorough although perhaps not to the extent of those conducted by CDEC. Results of these inspections are also used to update emission data information and to identify potential violations and modifications. As is the case with CDEC, any unrecorded changes which requires permitting is noted and followed up with a notice to correct deficiencies.

Inspections are also routinely made in conjunction with permits to construct and permit to operate. The IEPA inspectors view new sources to verify consistency with permit submittals and recommend issuance/denial of permits. When at the facility, inspectors will also view existing equipment to verify continuing compliance and to ascertain adequacy of operating and maintenance practices. The IEPA field staff will also go out on investigations initiated by citizen complaints.

4.6 COMPLAINTS

Community complaints concerning air pollution are registered with both the CDEC and IEPA Regional Office in Maywood, Illinois. Excessive particulates (visible emissions) and odors make up the majority of the complaints.

Of the 23 sources studied by PES in Chicago, seven had records of community complaints registered against them. Most citizen complaints were prompted by visible emissions and odor problems (chemical source). In some cases, specifically two of the steam generating plants, the complaints were brought on by temporary equipment failure but the source was otherwise in compliance. The other steam generating plant had a visible emission problem associated with soot blowing and installed a baghouse in response to the numerous complaints associated with this. But, it too was otherwise in compliance.

On the other hand, complaints were filed against sources that were indeed in continual violation (non-compliance) of the applicable regulations. The printing/publishing and secondary aluminum smelting source categories were indeed in non-compliance when complaints were filed against them. One source (mineral processing) had complaints stemming from both temporary equipment failure and a non-compliance status. However in this case, the non-compliance was related to fugitive emissions which were dependent on a climatic factor, wind.

In general, citizen complaints initiated quick responses by the source to correct the problem. The printing/publishing source was one source that utilized delay tactics in attaining compliance and a secondary aluminum smelter choose to take the legal/enforcement route thereby delaying compliance.

4.7 CONCLUSIONS

As indicated in the previous discussions, a variety of specific casual relationships between the control agencies and sources were surfaced during the industry visits. However, the data base for this study is statistically "thin" to draw broad or sweeping conclusions regarding the overall effectiveness of various strategies on enforcement techniques over others, in terms of bringing about resultant stationary source emission reductions. In the next two sections, we will examine potential changes to the regulatory process that could conceivably improve the overall cost-effectiveness of the control agency programs.

5.0 INCREMENTAL MODIFICATION TO THE EXISTING REGULATORY SYSTEM

5.1 INTRODUCTION

The foregoing chapters have illustrated the IEPA and CDEC programs maintaining compliance. With this background, we are now in a position to suggest modifications to the existing regulatory agency's programs which might potentially increase their effectiveness.

The incremental recommendation we suggest must be considered in the context that there are two regulatory agencies involved in the City of Chicago. Some of the suggestions are applicable to both agencies and unless implemented by both, they will be of marginal value. These suggestions are also made in the light of the currently existing constraints associated with the present state and city "environmental-related" administration regulations and other legal authorities. Finally our suggestions are constrained by the currently available manpower and budgetary allocations under which the IEPA and CDEC have been operating and are likely to continue to be operating.

The specific topics examined in the following sections include:

- Agency Organizational Restructuring
- Agency Interactions
- Permitting
- Inspections
- Emission Inventories
- Compliance Schedules
- Control Equipment
- Loans, Grants or Other Financial Assistance

5.2 ORGANIZATIONAL RESTRUCTURING

The CDEC and the Maywood Regional Office of IEPA being the local air pollution central agencies have primarily emphasized the initial compliance of the sources. Their main objective has been the gathering/verification of the data needed for initial compliance and assurance of continued compliance. Related activities include interaction with sources concerning compliance and data gathering for any enforcement related activities.

There is presently a shift in emphasis in the entire air pollution control process priorities. The Clean Air Act has been revised and there is a new emphasis on planning and the adoption of new rules and regulations. The original plans established with the Clean Air Act of 1970 have for the most part been implemented and time has shown that in some areas they are inadequate. The new rules and regulations would be corrective in nature. However the knowledge gained since 1970 should be utlized to the greatest extent possible. Hence, the renewed emphasis on the planning process.

The benefits of such an approach are many. The rules and regulations developed through proper planning would result in a strategy which would achieve both the state and federal clean air standards. Secondly the planning process itself is a mechanism capable of evaluating alternative control strategies and consequently select the most equitable, yet adequate alternative. This planning process would identify the manpower allocation necessary to implement the chosen and any other constraints which would hinder the implementation of the strategy.

The change in emphasis primarily affects the IEPA and its Regional Office at Maywood. Recent changes in the number of regional offices (down to three at the present time) have made the Maywood office responsible for the 19 northern counties in the state. There is also increased emphasis for the regional office to provide input into the planning process rather than to puruse enforcement/compliance related activities.

The CDEC is less affected by the renewal emphasis on planning. Indeed in accordance with the interagency agreement between CDEC and IEPA, the primary input to the planning process from agency personnel is general facility information and ambient air quality monitoring data. This data, however, is gathered for CDEC's purposes and may not be of optimal usefulness to IEPA in its planning processes.

It is difficult to draw any definitive conclusions with regards to optimum organization or staff allocations within any given structure without an in-depth study of all the program elements of the air agencies. Nevertheless, one specific recommendation can be made which is possible within the current constraints. A position of liaison officer should be established at both the IEPA office and at CDEC. This officer would be physically located at the sister agencies' office. This position should not be considered a management position but rather a senior staff position where the daily needs of the individual agencies' staff can be made known. At present the two agencies are autonomous and much of the information gathered is not useful for these sister agencies because it is not complete. A liaison officer who would have first hand knowledge of the other agencies' information needs can implement minor modifications in his own agency to the mutual benefit of both. Indeed many of the incremental modifications suggested below could easily have been recommended by such a liaison official.

5.3 AGENCY INTERACTIONS

The final programtic interaction between IEPA and CDEC is embodied in the interagency agreement which is updated annually. This agreement covers the programtic areas of air quality monitoring, emergency episode plans, asbestos demolition activities and general information., Additionally to avoid duplication and hence jeopardize federal funding levels, CDEC has the prime responsibility for small sources (< 100 TPY) while the IEPA is the lead authority for the large (> 100 TPY).

These prime function roles by size of the emitting facility has in practice minimized the other agencys' involvement in the other size category of sources. The interagency agreement should consider the mutual strongpoint of each agency toward a common end. For example, the roving inspectors can perform frequent checks on a large source and gather detailed information to aid the IEPA in enforcement activities or litigation. Conversely IEPA can provide technical assistance in control technology for small sources within Chicago. This would be extremely useful for unusual sources.

As suggested above the position of liaison officer could be extremely useful in coordinating the supportive activities of one agency to the sister agency's lead role activity.

5.4 PERMITTING

The present premitting process for sources within Chicago is dual in nature. A source must obtain permits from both agencies to operate. Improvements can be made in both systems and from the elimination of duplication.

The obvious recommendation is a single permit. However, this is a major rather than incremental change. The permit forms, however, are completely different yet contain a great deal of identical information. A single form could be developed which would contain three parts. First a section listing common information needed by both agencies in units agreeable to both. This information would include ownership, location, general description, etc. of the source.

The second and third sections would contain information needed only by CDEC or IEPA respectively. Alternatively a tri-column approach could be used. This would additionally permit dual units if so desired. In either case only one set of paperwork need be completed for both agencies. An additional advantage to this approach is that updated information useful to both agencies is gathered whenever one of the agencies needs more recent data.

For the CDEC itself, the permitting requirements include an annual renewal. However, only a cursary in-house engineering review, at most, is performed during this renewal. The inspector during the site visit does evaluate the source for continued compliance. However, the in-house review would support his conclusions on compliance espcially for chemical processes. At the minimum a spot check program of in-house reviews should be implemented.

For the IEPA, the present rules and regulations require that all permits and renewals be issued or denied within ninety days of receipt. This "permit-by-default" has been criticized by U.S. EPA in the reports on the audit of IEPA's new source review program. This critcism is compounded by the fact that all the initial permits were granted for a full five years and the renewals are being submitted at approximately the same time. While IEPA has stated that no one received a permit by default, priorities were set on verification of data due to manpower availability. IEPA has attempted to even out the next round of renewals by allowing, three, four or five years on the renewal permit. A further improvement would be to grant ,a short term permit of not longer than one year for those sources, which because of manpower shortages are only given a cursary review. The reviewed permit would also be flagged for a mandatory thorough review. This modification would continue IEPA's strong in-house review for renewals that they presently preform for new sources.

5.5 INSPECTIONS

The current inspection program of CDEC is one of its strong points. The mobile inspectors are highly visible and have been a motivating factor in continued compliance. Unfortunately this compliance is "opacity" related. Hydrocarbon emissions surveillance can be upgraded by equipping the enforcement patrol inspectors with portable combustible gas detectors which are currently available. The present complaint system which includes odors will become a starting point. However, to be really effective unannounced walk-through inspections would become necessary.

The annual renewal inspection, though a strongpoint now, can be improved upon in two ways. First, although these inspections are unannounced, they do occur at approximately one year intervals. A source owner inspected today, can be assured of no inspector for the next 11 months unless it is the result of a complaint or an opacity violation spotted by the mobile patrol. A random spacing of the inspections would be more effective. The second improvement would be the rotation of inspectors. At present an inspector retains the same surveillance area. While familiarity with the facilities in the area will be sacrificed, rotation will expose the inspectors to variety and will provide an element of performance evaluation and quality assurance.

The IEPA currently doesn't have an inspection program in the same sense as does CDEC. The regional office inspectors respond to complaints only for the large (100 TPY) sources and gather/verify data for some other programatic function (e.g. new source review, enforcement case-development, etc.). Since this criticism is really constrained by manpower allocation, perhaps the most effective mechanism is increased liaison with the CDEC. The CDEC roving inspectors could identify sources where follow-up inspections by IEPA would be highly effective. IEPA could provide the more through in-house engineering follow-up and could supply the showing of both agencies united toward the common end of the source remaining in compliance.

5.6 EMISSION INVENTORIES

Both CDEC and IEPA do have emission inventories. Their method of collection and the end use reflects in its quality.

CDEC collects emissions data during the annual inspection. The data is useful for trends and is based on AP-42 emission factors and annual use rates. A review of the emission data for boilers supplying comfort heat shows in some cases no change for several years indicated only estimates were used. Inspectors should review purchase records/production charts for a more accurate data source. Since CDEC uses this data for trend analysis only, this may be sufficient.

IEPA has amore thorough inventory which does include stack data in addition to fuel usage/process materials consumption. Like CDEC AP-42 emission by the requirement of major sources to submit inventory data. Unless requested the regional office does not verify this data.

IEPA should review this data more thoroughly and at least spot check its accuracy by the use of inspectors from the regional office.

Both inventory systems could be improved upon by increased cooperation and information exchange. CDEC could collect/verify emission inventory data annually during its renewal inspection. However, the data must be complete to be useful to IEPA. Again a common permit application which now does ask for inventory information could be used for the annual updates.

One set of emissions data currently collected by CDEC could be useful to IEPA. CDEC does permit small boilers of the residential/institutional size which are not required to obtain state permits. Emissions data is also collected. Despite the shortcomings described above, data is of use to IEPA in their planning programs. Currently IEPA uses general fuel purchases for this category source with estimating techniques for geographic distribution. The CDEC data for this category of sources would be more realistic and should be utilized in the planning programs.

5.7 COMPLIANCE SCHEDULE

There has been criticism by the General Accounting Office (GAO) that the allowance of excessively lengthy compliance schedules has contributed to the lack of timely reductions in air pollutants. Consequently, the attainment of the standards has been delayed.

Both IEPA and CDEC have used compliance schedules somewhat effectively, yet both show instances where improvements could be made.

IEPA has negotiated timely compliance schedules. However, in some cases the activity prior to the establishment of the schedule has not been expeditious. IEPA has had the track record of litigation rather than negotiating. This litigation phase has given sources substantial time. In some cases the time was sufficient for the source to come into compliance. Once negotiated however the schedules are adequate. IEPA should use enforcement conferences but de-emphasize where substantial progress toward a schedule is being made. This would also be cost-effective in that substantial effort could be saved on sources which are amended to a reasonable compliance schedule.

CDEC has used the opposite approach. Schedules have been negotiated which though quite lengthly achieved compliance within the time frame of the Clean Air Act. CDEC negotiated some schedules early in 1970 and while they were lengthy, the early start data resulted in controls by dates consistent with the goals of the Clean Air Act. CDEC does not pursue litigation as effectively as IEPA. However, their responsibility is primarily the smaller sources for which their negotiation has been most effective. Their approach has also been effective with major sources which are willing to make a good-faith effort to comply.

Compliance schedules is one area where the lack of cooperation and interaction is evident. The case study has shown instances where the source had negotiated a compliance schedule with CDEC was involved in litigation with IEPA. While differences will exist betwen the two agencies, in this case, non-interaction was evident rather than any basic differences in final objectives. Increased cooperation can be cost-effective for both agencies.

5.8 CONTROL EQUIPMENT

The effectiveness of reducing emissions is dependent on the installation and proper maintenance of control equipment.

Both agencies have been criticized for the inability to provide sufficient technical guidance on appropriate controls. This criticism is related mostly to specialized processes where no track-record of control equipment exists. CDEC has recognized its limitations and has cooperated with the sources in seeking solutions. IEPA, consistent with its litigation then negotiate approach, has simply insisted on solutions.

Both mechanisms have resulted in the ultimate control of equipment. However, the different attitudes conveyed by the source toward the two approaches differs as expected. IEPA's approach does force the source to take the safe way and dis-encouraging an attempt to try something new. CDEC would favor the conservative approach, however, their willingness to negotiate would encourage in some way new technology provided a reasonable likelyhood of success can be shown.

Incentives for sources to improve control technology are needed. However for the most part, they need substantial changes in the agencies programs. Within this constraint and within their legal limits, both agencies should encourage new developments even if this be nothing more than recognizable agency attitude.

5.9 LOANS, GRANTS OR OTHER FINANCIAL ASSISTANCE

Neither agency can provide financial assistance to the sources. However, both can utilize the public relations sections of their agencies to educate both the financial and industrial commitments of the need to install control equipment. Both agencies can also act as a clearinghouse of information for both sides. For the source, especially the small one, information on Small Business Administration Loans for control equipment, State and Federal Tax status of control equipment, etc. could be supplied. For the financial community educating them on the need for controls and indeed improved controls in order for economic growth to continue. This hopefully would encourage them to provde the funding needed to install, maintain and improve upon the needed control equipment.

6.0 OTHER MODIFICATIONS: SUGGESTIONS FOR FURTHER ANALYSIS

6.1 INTRODUCTION

In this chapter, we suggest more major potential modifications to the Chicago case study regulatory programs or strategies. Because of the nature of our overall effort, these considerations necessarily will be limited. Unlike the incremental modifications previously discussed, suggestions presented in this chapter might require additional enabling legislative, or other major administrative changes in order to facilitate their implementation. This chapter also considers the potential utilization of economic incentives for improving the activities of the State/local control agencies with regard to fostering more positive and consistent stationary source responses to these regulatory programs. Our suggestions are drawn from our experience with air quality and other domestic environmental programs, international approaches, and the professional literature. We do not, however, in this chapter attempt to suggest alterations to the National Ambient Air Quality Standards (NAAQS).

In the following sections we will briefly explore the prospects for new regulatory initiatives, as well as the potential problems associated with their implementation. In addition, we will attempt to highlight those prototype programs that have been under active consideration (or actually implemented) elsewhere. For the most part, these programs are all based upon the concept of more optimized regulatory cost-effectiveness which incorporates an emphasis on program flexibility in the facility/control agency decision making process.

6.2 PROGRAM PROSPECTS AND PROBLEMS

The existing regulatory structure within the Chicago area typifies the air quality "abatement and control" concepts which have developed during the past decade across the United States. Through a series of legislative directives, the air pollution control efforts in this country have evolved to a structure that is "objective" oriented. The nation has established threshold-related ambient targets or standards, and has adopted rigid timeframes for achieving the stated health-related objectives. In order to achieve these goals, a legislative mandate has been developed which focuses upon the abatement (or reduction) of pollutant emissions from existing industrial stationary sources (as well as other mobile sources); as well as a program aimed at the control (or prevention) of excess emissions from the construction of new facilities.

The 1970 Clean Air Act Amendments embodies a "technology-forcing: regulatory approach for the control of air pollutants that was highly complex with regard to the required frequency of interaction of all levels of government as well as the private sector. The Act entailed several types of permit or pre-construction and post-construction review processes; actions to insure that appropriate control equipment is installed; that effective operating procedures are developed and followed; and that economic and/or administrative sanctions be applied to bring certain sources within the requirements of the regulatory process. The Act also involves the considerable expenditure of manpower and funds by both government and the private sector. The preceding chapters have illustrated these factors as they apply to the Chicago case study.

The Clean Air Act Amendments of 1977 made several incremental changes to previous air pollution legislation. While the overall commitment to protecting public health was not greatly altered by the amendments, mid-course modifications to the technology-forcing strategy were included, since many areas of the country have failed to achieve the stated ambient air quality objectives. Specifically, the amendments provided for non-compliance penalties which were designed to eliminate the competitive advantages previously gained by industries which sought to oppose or delay the aims of the regulatory process rather than controlling their emissions. While proposed rules concerning non-compliance penalties were recently issued by the U.S. EPA, it is still too early to accurately determine their effectiveness. The addition of new extension and waiver provisions provides greater discretion to State and Federal officials than had been previously authorized. Still, it seems probable that the extension of attainment dates might remove pressure on polluters to develop new and cleaner technologies for the control of pollutants. Further, the Act still appears to fall short of providing for more effective measures of emission control "tradeoffs" in areas still striving to achieve the ambient standards. That is, it is still unclear as to how the economics of controlling various stationary and/or mobile source categories may be considered in the regulatory decision making process.

Other significant criticisms of the technology-forcing regulatory approach embodied in Clean Air Act have arisen in recent years. At the present time, these questions appear to be part of an emerging socio-political movement which generally critizes government regulation or regulatory "excesses" in numerous areas. With regard to environmental regulations, these criticisms are not only directed toward the claim that the overall pollution control costs may exceed the related environmental benefits, but also that substantial amounts of capital have been diverted from potentially more productive investments, productivity has been reduced, and that, in actuality, technical innovation has been impeded.

In conjunction with the above criticisms of the current legislative/regulatory framework, numerous studies have occurred (or are underway) which are aimed at exploring fresh approaches to solving and/or controlling the environmental issues. Many of these approaches are, as mentioned previously, based upon the concept of economic incentives. These incentives may be applied on the basis of emission taxes or surcharges, as well as other forms of subsidy. The overall characteristic of the economic incentive is that the concept provides the polluter with potential financial "rewards" for controlling its pollutant emissions. The financial incentives may be approached from the framework of controlling emissions within a set of prescribed units thereby minimizing or eliminating applicable "fees", or by applying financial penalties for facilities being out of compliance.

In this latter instance, the fee structure may be based upon emission increments above the prescribed levels, or may be based upon an approximation of the economic incentives that may be associated with continued non-compliance.

Regardless of the specific economic incentive programs selected, all of the programs offer similar favorable characteristics such as:

- Flexibility in the control methodology and decision making processes which is characteristic of the tremendous variability among sources (as noted with the rather small sample of facilities encountered in this study);
- Removal or reduction of the inequities that are inherent in any strategy based upon a "pure" emission standards regulatory structure that may not compensate for differences between sources and/or geographic areas;
- Encouraging further research into more effective methods of control technology while also providing an additional funding source in the form of tax dollars to finance air pollution control programs; and by
- Encouraging the speedy implementation of facility-specific controls which would improve air quality in the region of the source.

There are, of course, certain limitations to the pure economically based programs that should also be considered. While the program concepts do provide for incorporation of the environmental actions into the facility decision making structure the economic programs (in the form of emission taxes or surcharges) are not very useful in the control of extremely toxic substances. In these instances, prohibitory regulations should most likely be considered which would ensure that the levels of specific toxic pollutants are kept to an absolute minimum. Further, the regulations should also mandate the particular control programs to achieve the very lowest possible emission levels (i.e. the concept of lowest achievable emission rates or "LAER" instead of "BACT" or "RACT").

Other general limitations that should be considered include:

- The emission charge concept may not serve its intended purpose of reducing pollutant emissions unless the fees or taxes are set high enough to provide the necessary financial incentive;

- The current Federal (and some state) tax structures would tend to allow businesses affected by the regulations to "write-off" the emission fees as normal business-related expenses, which may also serve to remove or reduce the true financial incentive to reduce pollutant emissions;

- The possibility that emission fees may provide a new source of revenue which should not be considered as a mechanism to supply funds to program areas other than those specifically related to air pollution control.

Other control program approaches that should be considered include those related to emission reduction "markets" (i.e. emission offsets and banking), innovative control technologies, and the more efficient/ effective coordination of environmental programs. Each of the above program areas will be briefly reviewed with respect to the Chicago case study.

6.3 PROGRAM PROTOTYPES AND REGULATIONS

In the previous sections of this report, we reviewed the historical structure and regulatory interactions associated with the Chicago case study. In particular, we reviewed the agency/source relationships and/or response mechanisms associated with the State (IEPA, IPCB) and local (CDEC) control agencies, and the 500 - 600 major stationary sources in the City of Chicago. The regulatory concepts concepts introduced above and discussed further below would most likely not fit into the current legislative structure of the Illinois Environmental Protection Act or the City of Chicago Municipal Code. However, with proper modifications to the enabling legislation, we believe that the programs addressed herein would conceivably improve upon not only the environmental protection strides achieved to date, but also upon the overall cost-effectiveness of the regulatory/source programs involved in achieving these goals.

6.3.1 ECONOMIC INCENTIVES

Considerable attention has been directed toward an examination of economic incentives. Characteristics of these analyses tend to reflect the particular perspectives of their respective authors. These have included an examination of firm-specific approaches, factors inducing technological change, legal aspects, specific industries, and specific control option costs. In a series of publications by Downing and Watson, insight into the effectveness of several alternative regulatory approaches is provided, but the basis for conclusion is limited by virtue of the fact that these studies concentrated on the enforcement of the new source particulate matter discharge standard for coal-fired power plants. Infrequent attempts have been made to base theoretical formulations on systematically collected empirical data which represents a variety of sources interacting with a regulatory authority.

One particular study by Downing and Watson on the subject of economic considerations in enforcing environmental controls does provide substances with respect to the Chicago case study. In particular, a conceptual analysis was provided with respect to optimal emission standards and taxes or emission fees. The investigation relates to how the cost to a particular firm in complying with applicable control requirements and the cost to society (i.e. regulatory agency program costs, etc.) in insuring that the firm complies, affects the optimal level of pollution control. The analysis is provided with respect to the legal enforcement regulatory framework (as currently exists in the Chicago case study), and an effluent or emission fee enforcement framework. This relationship is reproduced in Figure 6-1 for the legal enforcement structure.

As indicated in the figure, the concept is based upon the diminishing marginal costs of control, as a function of increasing percent of pollutant removal (R) and overall costs to comply. The analysis notes that regulatory requirements should not be based upon an "optimal" solution that equates the marginal cost of the control device (MCD_{LE}) to the declining marginal benefit function (MB). This is due to the fact that the marginal social costs (MSC_{LE}) include not only a consideration of control costs, but also all of the enforcement and/or administrative costs encountered by the frim (MCC_{LE}), as well as the marginal costs incurred by the control agency(ies) in enforcing the regulations (MMC_{LE}). Thus, the true "optimum" control level is found where the marginal social costs equate to the marginal benefits function. As noted in the figure, the tendency to overlook these additional costs could result in over control.

In the Chicago Study, the average costs of the control devices were approximated on a "per facility" basis, as were the average control agency costs (see Section 2.0). Although the approximations reflect average costs only, they reinforce the importance of considering the full marginal costs of control, not only the control device, but the full social costs also. Thus, as noted in Section 2.0, the average control agency costs on a "per ton of pollutant reduced" basis are ever increasing, and should be weighed against the related facility marginal costs of control in assessing future regulatory changes. Downing and Watson went on to note that the optimal effluent or emission fee system is a combination of the marginal effluent fee equal to the marginal control costs to the firm (MCC_{EF}), at the pollutant removal rate where the marginal social costs intersect the marginal benefits function, plus a fixed emission

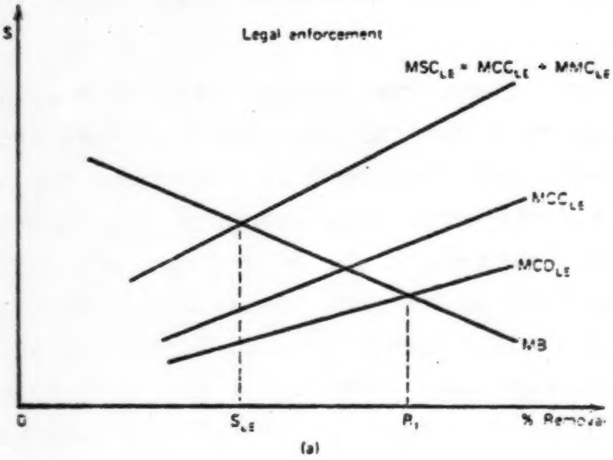


Figure 6-1 LEGAL ENFORCEMENT

Source: "Economic Considerations in Enforcing Environmental Controls", Paul B. Downing and William D. Watson, Jr., Washington Environmental Research Center, U. S. EPA.

fee equal to the total annual management costs imposed on the control agency by the particular firm.

6.3.2 EMISSION REDUCTION MARKETS

The control efforts related to the emission reduction markets are primarily applicable to achieving the SIP goals in areas currently not attaining the standards. However, the concepts would also be applied for related programs such as maintenance of the ambient standards and/or PSD. Under an emission tax incentive program, each polluting source in the Chicago area would be required to pay a tax or fee on every unit of pollutant released in the area. The stationary source would reduce emissions as long as the control cost was below the level of the tax. Thus, all sources would reduce their emissions up to the same marginal control cost which equals the tax rate. The ultimate control solution should reflect the least control cost. The concept could replace the current emission regulation approach now used in Chicago, but would require continuous monitoring for effective enforcement. Because this system serves to reduce emissions by sources in a given area, the approach would probably not be effective in areas where only one or a few sources are responsible for a non-attainment problem (which is not the case in Chicago). Further, the approach would also be inappropriate in attempting to control area-source pollutants such as fugitive dust or area-wide hydrocarbon emissions.

Another alternative would involve the application of an emission surcharging system, which is similar to the emission tax concept except that it may be used as an enforcement tool in conjunction with existing regulations (primarily for TSP and SO_2). Under this system, a certain level of "free" emissions would be allowed, with a tax surcharge imposed for each unit of emission above that level. If the incentive program is fully effective, no revenues would be collected since sources would pollute only to the allowable level.

Another concept potentially applicable to the Chicago area would be an emission banking approach. Here, an emission bank would establish a maximum level of allowable emissions for a given area (e.g. the City of Chicago, or the Chicago CBD). Every source in the area would be required to purchase a permit for all emissions released. Thus, the total number of permits sold would correspond to the maximum allowable emission level, with prices determined by competitive bidding. New facilities wishing to enter the area would be required to purchase permits from existing sources, which would insure that all additional increases in pollutant emissions would be matched by an equal (or potentially greater) reduction from existing sources. Trading or rights would allow industrial expansion within the allowable limits without further incentive-related adjustments by the control agencies.

The emission banking concept may also be combined with the emission tax approach to provide for an activity tax strategy. Here, the tax may be levied upon the product output of a particular industry (such as the ferrous metallurgical industries in South Chicago), instead of taxing the facility emissions. Thus, the products of the more heavily polluting industries could be taxed more heavily than those of the less polluting industries.

One final strategy for consideration (although not fully recommended) would involve the optimal direct control concept. Here, emission limitations would be developed and set individually for each stationary source in a region. In theory, the regulations are set so as to equalize the specific marginal control costs for a given facility thereby providing for an economically efficient control system. However, this scenario requires detailed source-specific control and administrative cost information and may not be effective in regions such as Chicago, where numerous sources are interacting in a non-attainment problem.

6.4 COORDINATION OF ENVIRONMENTAL PROGRAMS

We have noted in several instances in the course of performing the Chicago case study that the objectives of single media environmental programs might be counterproductive with each other. For example, an effort to reduce air pollutants has in several instances resulted in increased water pollutants or solid waste management problems. This also applies in some cases to the requirements of OSHA and TSCA, which have established extensive mandates for the control and handling of toxic or hazardous materials. Furthermore, our discussions with the stationary sources have revealed considerable opposition to the proliferation of single media permits and permit requirements which they must follow coupled with the coordination problems associated with the dual agency permit systems. The effort involved in following these requirements has increasingly consumed larger percentages of industry-related manpower and budget. The burden is felt greatest among the smaller sources, which have found it increasingly difficult to cope with sometimes fragmented environmental initiatives.

In recent years, increasing efforts have been directed towards the effective integration of existing and/or new single media environmental programs. These efforts have taken the form of federal interagency agreements or policies, as well as the operation of the A-95 clearinghouse. In addition, increasing empahsis has been placed on interrelating the technical and administrative requirements associated with ongoing permit programs that includes PSD, EIS reviews under the National Environmental Policy Act (NEPA), Army Corps of Engineers water permits, and the State/local NSR process. The EPA is continuing in its review of this process, and has expressed the policy of striving to unify as many regulatory processes as possible. The recently proposed Integrated Environmental Assistance Act would provide for the transfer of up to 20 percent of an agency's funds between single media programs to provide for more effective intermedia program coordination. Further, the proposed legislation would enable states to draw upon funds for intermedia program planning and funding, by providing up to $25 million for innovative program research.

At the State/local level as they pertain to the City of Chicago, increased emphasis must be placed on improved single andmulti-media program coordination between the IEPA and the CDEC. Now legislative initiatives (utilizing the program concepts discussed above) should be considered to minimize or eliminate duplicative program areas that have occured through the Illinois Environmental Protection Act and the City of Chicago Municipal Code. A reconsideration of overall program effectiveness could result in a more efficient and effective regulatory effort through the combining of the city/state permit and enforcement/surveillance programs. Such an effort, although recognized as being somewhat difficult to coordinate, would result not only in a more cost-effective utilization of limited resources, but also the potential for improved cooperation on the part of industry through the removal of duplicate or sometimes contradictory regulatory efforts.

7.0 CONCLUSIONS

This study has shown that the two agencies, IEPA and CDEC have markedly different approaches toward achieving and maintaining compliance with the applicable emission regulations. CDEC in general has taken a high exposure approach with frequent interactions with the sources, annual inspections, roving inspectors, quick response to complaints, etc. IEPA on the other hand has been more remote, e.g. data gathering, by questionnaire, litigate rather than negotiate, etc.

The overall success of the combined approaches cannot be denied. An analysis of the emission reduction trends data indicates that progress has definitely been made in reducing pollutant levels in the City of Chicago. The general in quality for all three pollutants involved in this study (TSP, SO_2, HC) has improved. Additionally the magnitude and geographic coverage of the violations of the ambient air quality standards has shrunken dramatically since the passage of the Clean Air Act of 1970.

The CDEC's strengths begins with its required sign-off on all building permits. In Chicago it is difficult, if not impossible, to construct anything without a building permit. Therefore no new source could be constructed without CDEC's approval. In addition after a source is built, it is subject to CDEC scrutiny each year for the renewal of its certificate to operate, which is issued only after its annual inspection. This inspection insures no modifications in equipment and that it is maintained. CDEC continues its strong visibility with its enforcement patrol. These inspectors offer quick response to complaints, investigate opacity violations and issue tickets for violations detected. CDEC is also highly visible in its approach with the source negotiation of a compliance schedule and frequent checks on the schedule are evident.

The weakness of their approach is that the inspectors are not highly trained engineers and that most inspectors are cursury in nature. The annual inspection is of a walkthrough type to verify equipment, its usage and general compliance. No detailed analysis of the source is made nor data collected to do such a review in-house. Additionally, the annual inspections occur at the same time each year. Negotiation rather than litigations has resulted in what might be considered length compliance schedules.

IEPA's strong points reside in their detailed engineering reviews and the renewal system of permits. Each renewal re-subjects the source to another engineering review. IEPA has a strong stance on litigation rather than negotiation.

Both of these strengths affect their weakness. The detailed engineering review coupled with a 90 day processing period mandated by state statute constrains the agency from verifying much of this data. The first round of renewals had the same shortfall since most of the permits became due at the same time.

IEPA's strength in litigation has likewise contributed to its poor track record. Heavy caseload affected quality and delaying tactics used by some sources were sufficiently long enough to implement complying controls rendering the litigation moot. Non-selective litigation rather than negotiation has not had a good track record.

The different approaches have each been effective in varying ways. The constant surveillance by inspectors has been most effective for TSP controls and against the smaller sources. SO_2 emissions from combustion processes were on a downward trend since the last 60's when fuels of greater than one percent sulfur were prohibited. This rule also aided in the reduction of TSP since compliance resulted from substantial fuel switching.

Hydrocarbon reductions have been accomplished mostly through solvent switching (Rule 66). In those cases where other approaches were taken, it was IEPA with its engineering knowledge which proved to be most effective.

The study showed no great differences by category type. Differences in the agencies program effectiveness was related to the pollutant discharged and complexity of the pollutant source. Generally particulate control technology is the best developed and compliance followed readily for sources using proven technology. Complex processes with multi-pollutants were the slowest in achieving compliance and have had the most problems maintaining them.

Another categorization on the effectiveness of the achieving compliance and maintaining compliance was source size. Smaller sources moved towards compliance faster. However initial capital investment was the prime factor for selecting the control technology. This decision has in some cases proven to be short sighted. Serious operational problems and/or expensive operational problems and/or expensive operational costs have affected continued compliance. Larger sources delayed compliance by challenging the litigation proceeding of IEPA. These time delays provided the planning period needed to develop better long range controls.

The analysis concludes with recommendation for incremental changes in both the CDEC and IEPA programs to become more effective. These recommendations can be summed into the improvement in interagency cooperation. The strengths and weaknesses of the two agencies complement each other. Increased cooperation will result in more effective programs for both. Major recommendations were also reiterated. Foremost in one-step permitting where the source would interact with both agencies concurrently to obtain the needed air permits.

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